"Essays in Health Economics"

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Abstract

As the American healthcare system changes, policy makers and healthcare providers are in need of more data and improved analytical strategies. Researchers are taking advantage of changes to the healthcare system and new data to evaluate and understand policy changes and healthcare effectiveness. The healthcare system will be expected to do more with less and governments will be required to better organize and regulate healthcare markets to address public health concerns and fiscal necessity.

As a result of these changes and policy concerns, economists are studying the healthcare system with newfound interest and newly generated questions. The following dissertation adds to the economic study of health care. Chapter 1 examines the relationship between specific variations of joint and several liability tort reform and the growth rate of medical expenditures. Chapter 2 discusses the relationship between emergency department outcomes for trauma patients and the patient's insurance. Lastly, chapter 3 investigates whether a patient's insurance has an impact of patient outcomes and treatment patterns. Chapter 3 also evaluates the effect of the Great Recession on the relationship between insurance status and treatment patterns.

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INTRODUCTION

This dissertation seeks to investigate and understand the relationships between healthcare, healthcare financing and healthcare spending. It does this in three chapters. The first chapter investigates the relationship between tort reform laws and healthcare spending growth. The second chapter explores the relationship between health insurance and the treatment patterns for injury patients. The last chapter examines the relationship between heart attack outcomes and health insurance in the emergency departments using a novel method of controlling for underlying health status.

First, one explanation for increases in healthcare costs has been malpractice lawsuits. States have introduced several types of tort reforms in an attempt to control increases in healthcare costs. This paper adds to the literature by examining how the differences in joint and several liability reforms affect the state-specific growth rate in healthcare expenditures. Additionally, the paper addresses the potential for a fundamental difference between states that pass different types of liability reform. The results show that joint and several liability reforms that limit joint liability based on percentage of blame have statistically and economically significant impacts on healthcare expenditure growth rates.

Second, health economics researchers have long known insurance status has an impact on the use of health care system (Hadley 2003); however, measuring the causal effect of insurance status on treatment decisions and outcomes has been a difficult problem for economists to tackle. This paper builds upon earlier work by Doyle (2005) in examining the effects of insurance status on injury patients in the emergency room. Doyle (2005) uses a Wisconsin sample of patients reporting with injuries resulting from motor vehicle accidents. The present examination improves on Doyle's study by broadening the dataset, controlling for overall health status and considering multiple types of health shocks. I use a nationwide dataset of emergency department visits to

compare the differences between the effects of insurance status on treatment for patients with injuries from motor vehicle accidents and patients with other types of injuries while controlling for overall health status. This paper reaches three primary conclusions: (1) Patients paying out of pocket experience worse health outcomes; (2) Patients paying out of pocket receive fewer health services in response to motor vehicle accident injuries and other types of injuries; and, (3) Despite no observed differences between patients paying out of pocket and patients receiving charity care, charity care patients generally received more healthcare services and had better health outcomes than patients with private insurance.

The third paper investigates whether health insurance status has an impact on survival and admission probabilities for heart attack patients presenting through the emergency department. Heart attack patients are frequently used to evaluate the impact of insurance status as they nearly always require immediate emergency treatment. This suggests the decision to seek emergency treatment could be independent of the decision to purchase health insurance and relieves some concerns about endogeneity problems.

To accomplish this, the paper uses a methodology from Currie, MacLeod and Van Parys (2016) to address endogeneity and evaluate whether the differences across different types of health insurance. Using data from the 2006-2011 HCUP NEDS, I show patterns in the probability of death, hospital admission and treatment patterns patients with a primary diagnosis of acute myocardial infarction, commonly known as a heart attack before, during, and after the Great Recession.

This work shows the effect of insurance status, Medicare, Medicaid, out of pocket, and charity care with respect to privately insured patients changes across pre-recession, recession, and post-recession discharges. Specifically, charity care patients experience a nine percentage

point increase in the probability of admission between recession discharges and post-recession discharges. This corresponds to charity patients being 122.7% more likely to be admitted than similar privately insured patients. However, this work leaves open the degree to which this effect is a result of the end of the Great Recession or the passage of the Affordable Care and Patient Protection Act of 2010. Furthermore, this research does demonstrate the importance of understanding the decision to provide charity care and explores avenues further research.

CHAPTER I

"TORT REFORM LAWS: DO DETAILS MATTER?”

For policy-makers, determining how to bend the cost curve of healthcare down is an incredibly important task. Healthcare costs in the United States have increased to 17.9% of GDP in 2013 and are projected to increase as a proportion of GDP, to 19.6% in 2021 (National Health Expenditures Projections, 2011-2021). Healthcare costs have increased much faster in the United States than the OECD average than in other major industrialized countries and the US cost curve for medical expenses lies above the cost curves for other major industrial nations. (Kaiser Family Foundation, 2011).

As a result of rising healthcare costs, policy-makers have enacted different policy prescriptions to bend the healthcare cost curve downward. A frequently proposed solution is the passage of several different types of tort reform. For example, Both the Bush and Obama administrations have discussed the importance of a federal tort reform law to control cost growth (Born, Viscusi & Baker, 2006; Mello, Chandra, Gawande, & Studdert, 2010). The Congressional Budget Office advocated tort reform in a letter to Sen. Orrin Hatch in 2009 (Congressional Budget Office) and the American Medical Association (AMA) and other professional organizations advocated tort reform in a letter to President Obama in 2009 (American Medical Association). Several states have implemented various tort reform laws (Avraham, 2011).

Moreover, economists have repeatedly evaluated the effectiveness of such tort reform laws in containing healthcare costs (Avraham & Bustos 2010; Kessler & McClellan 1996; Viscusi & Born 2005; Avraham, Dafny, Schanzenbach 2009; Paik, Black, Hyman, Silver 2012; Sloan & Shadle 2009; Matteo & Matteo 1998). These studies have approached the questions from several different perspectives, but have failed to reach a consensus. Furthermore, both economic and legal literatures examine only the presence of liability reforms, not the specific ways liability reforms are written. The main contribution of this paper is therefore considering whether different types

of reform to liability law across the states have different impacts on rates of healthcare spending growth. Additionally, this paper also uses several different strategies to evaluate the robustness of the results.

I.I Tort Reform and Healthcare Costs

Tort reform laws vary considerably across the states, and dissimilarities in these provisions may have different effects on healthcare expenditure growth. The literature discusses different types of tort reform including caps on total damages, caps on non-economic damages, caps on punitive damages and joint and several liability reforms.[1]

Tort reform is related to healthcare costs in two primary ways, medical malpractice premiums and "defensive medicine." In their simplest form, the direct goals of tort reform are quite clear—to cause plaintiffs to face higher costs, lower benefits and greater uncertainty in damage awards (Avraham & Bustos 2010).

Additionally, there are also indirect goals of tort reform. By decreasing the likelihood of being the defendant in a tort lawsuit, proponents of tort reform claim doctors will be less likely engage in "defensive medicine," medical procedures without very few likely health benefits and very high financial costs only to prevent possible malpractice claims (Kessler & McClellan 1996). Therefore, there are many different mechanisms by which tort reform can affect healthcare costs and charges in the economic theory.

A large portion of the research on the effects of tort reform investigates the effects of damage caps. First, Kessler and McClellan (1996) use three years of Medicare claims to investigate the effect of damage caps on individual medical expenditures. In 1984, 1987, and 1990, they show

[1]A more extensive literature review is included in the appendix in Table AI.

the implementation of damage caps has a negative effect on medical expenditures, while having no impact on measures of health outcomes.

These authors show a similar result in their 2002 paper reviewing the effects of damage caps on expenditures and health outcomes for elderly cardiac patients. Using care data from 1984 until 1994, Kessler and McClellan (2002) investigate the effects of tort reform and managed care and show that damage caps have a significant negative effect on hospital expenditures.

However, other research has investigated the impacts of joint and several liability tort reforms. Joint and several liability reform (JSL) is an attempt to link liability directly to individual actors. Traditionally, medical liability has been viewed as joint liability, meaning any entity or individual associated with the injury can be held fully liable for all damages. This allows plaintiffs to sue "deep pocket" actors, such as hospitals, for full damages even though they had very little to do with the malpractice. For example, under a regime of joint liability, a plaintiff could sue only the hospital and receive full payment for all damages. Under a several liability reform, the plaintiff would have to sue every actor involved in the malpractice to collect full payment for damages. Joint and several liability reforms use several methods of limiting the application of joint liability and mandating the application of several liability in a variety of situations.

Several researchers have investigated the effects of joint and several liability reforms on healthcare and medical costs. Currie and MacLeod (2008) and Carvell, Currie and MacLeod (2012) investigate the effects of joint and several liability reform on pregnancy complications and accidental death rates. This research demonstrates that liability reform reduces pregnancy complications and reduces accidental death rates, suggesting tortfeasors take more care under regimes of several liability. The authors conclude that doctors, knowing they must be sued for the plaintiff to collect full damages, are more careful. This argument does not rely on defensive

medicine or an increase in the number or amount of malpractice claims, but instead on an actual decrease in medical malpractice.

Researchers have also considered the effects of JSL reform on other outcomes. Avraham (2007) show JSL reduces the number of malpractice payments made. Furthermore, Avraham and Schanzenbach (2009) and Avraham, Dafny and Schanzenbach (2010) show JSL reform deceases the rate of individuals covered by private insurance companies but also reduce insurance premiums by 1-2% respectively. Additionally, Viscusi and Born (2005) show JSL also decreases malpractice insurance company loss ratios and can increase malpractice insurance company profits. They conclude this means malpractice companies are paying a smaller amount to plaintiffs in malpractice lawsuits. Lastly, Sloan and Shadle (2009) show JSL reform may decrease Medicare payments for hospitalizations; however, this finding was not robust to multiple specifications. These authors also suggest JSL must have an impact on healthcare costs. They induce JSL reform must decrease healthcare costs because malpractice payments are fewer and smaller and insurance premiums are decreasing. However, there is no direct evidence for this claim.

Despite several JSL reform studies, none of the existing research attempts to provide any direct evidence about healthcare costs or insight into the differential effects of different types of joint and several liability reform. This paper builds on previous research by directly addressing costs by using the growth rate of healthcare costs and by examining the effects of different types of JSL reforms. States have implemented JSL by banning joint liability, limiting the circumstances in which joint liability can be applied, and defining 'fair-share' liability laws.[2]

I.II. Data and Empirical Methods

[2] Table AII presents the distribution of states implementing different types of joint and several liability reform.

I assembled panel data for states for 1996 to 2009 from a variety of different sources. The primary dependent variable is the annual percentage growth in personal healthcare by state. This data was collected from the 2011 Health Expenditures by State of Residence database from the Kaiser Family Foundation State Health Facts (http://kff.org/statedata/). State income data were collected from the Bureau of Economic Analysis. The demographic variables for the states were collected from the U. S. Census Bureau. Health status variables that may affect healthcare expenditures were collected from the CDC's Behavioral Risk Factor Survey. Lastly, data about the type and timing of tort reforms were found in the Database of State Tort Law Reforms 4th Edition (DSTLR-4), the most comprehensive and well-maintained database of state tort laws (Avraham, 2011).

[Insert Table I.1 here.]

Furthermore, Figure I.1 presents a box and whisker plot of the growth rate in per capita health care expenditures illustrating the variability in state healthcare expenditure growth rates.

[Insert Figure I.1 here.]

This paper will use a difference-in-differences model with fixed effects to estimate the causal impacts of tort reform laws. In the panel of fifty states we can examine the differences in the average growth in personal healthcare spending. This model with fixed effects will control for time and state invariant characteristics. Therefore, the econometric model that will be estimated is

$$Y_{st}=\beta_0 + \beta_1 R_{st} + \beta_2 X_{st} + c_s + \nu_t + \varepsilon_{st}$$

where Y_{st} is the year over year percentage change in personal healthcare expenditures, R_{st}= 1 if the state, s, had a specific tort reform law in effect at time t. Therefore, β_1 is the difference in differences parameter of interest. Further, X_{st} is a vector of time-varying control variables.

Following the model estimated in Cuckler and Sisko (2013), the variables included in the estimation are the percentage change in the proportion of the state's population that is uninsured, the percentage in per capita community hospital beds in a state, the percentage change in the African-American, female and over age 65 proportions of the populations, the percentage change in real income and the percentage change in the "bad health index". The bad health index was created to follow the index in Cuckler and Sisko (2013) and is defined as the product of the proportion of the population that smokes and the proportion of the population that is obese for a given state. Lastly, c_s and v_t are state fixed effects and time fixed effects respectively. Standard errors have been clustered by state.

I.III. Results

The basic results are shown in Table I.2. First, as a state becomes more African American, health expenditure growth decreases. Second, as real income grows, the growth in health care spending also increases. Additionally, this evidence also shows that the impacts of JSL reform are large, reducing aggregated personal healthcare expenditures by .477 percentage points. However, several different types of liability reform are captured by measuring the effects of JSL reforms. An outstanding question is whether different types of liability reform have differential impacts across healthcare spending. Evaluating the different impacts of different types of liability reforms is the primary contribution of this paper to the existing literature.

[Insert Table I.2 here.]

The different types of liability reform are joint liability bans (Ban), limiting joint liability to situations where the responsible defendants acted in concert (Concert), limiting joint liability to situations where the responsible defendants acted with intent (Intent), limiting joint liability to situations where the defendant is responsible for at least 50% liability (Fifty), where the plaintiff

is blameless (Blameless), where the defendant bears more responsibility than the plaintiff (Greater), and a synthetic variable that accounts for any situation where the defendant bears more responsibility than the plaintiff (Any). The Any variable includes any state with either a greater liability standard, fifty percent liability, or blameless plaintiff joint liability rules. These independent variables are listed in the first column of tables I.3 through I.5.

The dependent variables are listed in the top row of tables I.3-I.5. These dependent variables are different types of healthcare spending growth. The first category is growth in aggregated healthcare expenditure, which spending on hospital care, home health care, nursing home care, physician and professional office visits, prescription medications, dental care and durable medical equipment. The next four categories are specific types of healthcare spending--growth in expenditures for hospital care, home health care, nursing home care and professional services, such as doctor visits. Additionally, in the following tables each cell contains an estimate and robust standard error for separate regressions.

The next set of results are presented in Table I.3. Using disaggregated spending growth, the analysis can help determine if specific JSL reforms has a statistically significant impact on different sources of healthcare expenditure growth. While all forms of personal spending growth are negatively correlated by JSL reform, only aggregate spending growth and physician and professional services are significantly affected by any JSL reform when all types of JSL reforms are combined.

[Insert Table I.3 here.]

There are meaningful differences in the effects of different forms of JSL reforms. For example, joint liability bans are never associated with statistically significant decreases in spending growth. Limiting joint liability to defendants who acted in concert and defendants who act

intentionally have both positive and negative statistically significant effects on different forms of healthcare spending growth. Reforms limiting joint liability to cases of intentional torts lead to a 1.1 percentage point increase in the growth rate for hospital spending, but a negative 2.2 percentage point decrease in the growth rate for physician spending. Acts in concert reforms are associated with a 5.3 percentage point increase in home health care spending growth and a 1.2 percentage point drop in the growth in nursing home spending. Similarly, reforms limiting joint liability to defendants who are at least fifty percent liable is associated with a 3.4 percentage point increase in the growth rate of home healthcare spending and a 1.2 percentage point decrease in nursing home expenditure growth. Also, the synthetic variable for any type of JSL reform that limits the application of joint liability to cases where the defendants are at least as liable as the plaintiff is associated with a 1 and 1.8 percentage point decrease in aggregate spending growth and nursing home spending growth respectively.

More importantly, the JSL reform that limits joint liability to situations where the plaintiff is blameless or defendant bears more blame than the plaintiff have negative statistically and economically significant effects on expenditure growth rates for aggregated personal expenditure growth, hospital expenditure growth, nursing home expenditure growth, and physician services expenditure growth. Blameless plaintiff reforms are associated with a .4, 2.9 and 1.3 percentage point decrease in aggregated, hospital and clinical services spending growth respectively. However, blameless reforms are also associated with a 1.2 percentage point increase in hospital spending growth. Reforms that are written such that the defendant can be held jointly responsible so long as s/he is more liable that the plaintiff are associated with approximately 1.2, 2.1, 2.1 and 1 percentage point decreases in aggregated health spending, hospital spending, nursing home spending and spending on clinical services.

To investigate the whether these results extend to government health insurance programs, I also will examine the effects of JSL reform on Medicaid and Medicare expenditure growth rates. However, interpreting the impacts on Medicare and Medicaid spending growth may be complicated due to the programs' insulation from market forces.

Table I.4 presents estimates where the dependent variables are limited to Medicare expenditure growth rates. These results are rather similar to the results presented in Table I.3 above. Again, any type of JSL reform results in lower rates of aggregate spending growth per enrollee. Additionally, fair share reforms are again associated with an approximately one percentage point decrease in spending growth. However, there are two cases worth particular mention. The blameless plaintiff reform is associated with a nearly nine percentage point decrease in the growth in home healthcare spending and the reform limiting joint liability to defendants bearing more liability than the plaintiff is associated with a nearly three percentage point increase in home healthcare spending growth.

[Insert Table I.4 here.]

Implementing a ban on joint liability is associated with a 2.2 percentage point decrease in aggregate spending growth and a nearly eight percentage point decrease in home healthcare spending growth. Given the difference between the effects of JSL reforms on Medicare enrollee spending growth on home healthcare and the effects of JSL reforms on per capita spending growth on home healthcare, additional consideration is necessary to fully understand the economic mechanisms at work. The different results may be a result of the fact that Medicare patients are largely elderly patients or different incentives between private medical arrangements and Medicare surrounding home health care.

Table I.5 displays the regression coefficients of JSL reforms on various forms of Medicaid expenditure growth. Unlike Medicare expenditure growth in Table I.4, there are few cases where JSL reforms have an economically and statistically significant effects. Any JSL reform, joint liability bans, in concert reforms, reforms where the defendant must bear at least 50% responsibility and the synthetic variable grouping the 50% reform, and reforms where the defendant is more liable than the plaintiff reform have no statistically significant impacts on any form of spending growth.

[Insert Table I.5 here.]

On the other hand, the intentional tort reform and blameless plaintiff reform alone are associated with large decreases in the growth rate. The intentional tort reform is associated with a 2.7 percentage point decrease in aggregated spending growth and a nearly 11 percentage point decrease in the growth rate of spending on physician services. Furthermore, the blameless plaintiff reform alone had large and statistically significant impacts on aggregated spending, hospital spending, nursing home spending and spending on clinical services. Oddly, however, the blameless plaintiff reform is also associated with a nearly 14 percentage point increase in the growth rate of spending on home healthcare. The reason for this result is unclear; however, it may be related to the specific nature of the Medicaid program. Further research should investigate patterns of home healthcare use in Medicaid programs.

At this point, it is appropriate to note that Medicaid is a state run program and state-level changes to the administration of Medicaid are not accounted for in this analysis. Therefore, the large, and sometimes anomalous, effects of JSL reform on Medicaid spending growth rates may be related to some third factor that is associated with the states that pass restrictions on joint

liability and state control of the structure of Medicaid. Failing to control for this possibility might be biasing these estimates in some way.

I.IV. Different States, Different Reforms?

There could be something different about the states that implement different types of joint several liability reform laws. It seems possible that states with lower levels of expenditure growth could be more likely to enact fair share liability reforms and states with higher levels take a more drastic reform, such as banning joint liability outright. In this case, the effects of fair share reforms may not be economically significant, rather an artifact of states with preexisting lower growth rates.

To evaluate this possibility, I created three lead variables for each of the types of reform.[3] Table I.IV presents the estimates for the first three leads for aggregated personal spending growth. Generally, instead of seeing a statistically significant decrease in spending growth before the implementation of a JSL reform, there were frequently large increases in personal spending growth. This indicates the results above are not capturing an already existing bend in the personal cost curve. The exception to this pattern is the one-year lead of the acts in concert reform is associated with a 1.2 percentage point decrease in aggregated personal spending growth.

[Insert Table I.6 here.]

Tables I.7 and I.8 present the results of similar tests for the impact of the leads to JSL reforms to the expenditure growth of Medicare and Medicaid respectively. For Medicare spending growth, we see negative and statistically significant effects of many different reforms, suggesting an additional causal variable that may be biasing the results in section I.II above. Furthermore, the

[3]However, the leads for the blameless and the greater liability variable created too much multicollinearity to yield reliable standard errors and are therefore excluded from this analysis. The results only include leads for general JSL reforms, JSL bans, reforms focused on intentional and acts in concert, fifty percent liability and the synthetic variable that includes reforms where the defendant bears greater liability.

leads in the regressions for Medicaid spending growth per enrollee are almost never associated with statistically significant effects, positive or negative. One exception, the three-year lead of banning joint liability, is associated with a nearly six percentage point decrease in aggregated per enrollee Medicaid spending growth.

[Insert Table I.7 here.]

[Insert Table I.8 here.]

I.V. Placebo Tests.

Finally, the above analyses require an assumption about the distribution from which the regression coefficients are drawn. However, several researchers have used randomization tests to generate a 'true' distribution of the coefficients for inference. Following the work of Helland and Tabarrok (2004) and Donohue and Wolfers (2006), I randomly match state-level reforms to state levels of growth in healthcare expenditures. Then, I repeatedly estimate the econometric specification from above to generate the distribution of coefficients. By using the standard errors from this distribution, I can again calculate the t-statistics to reevaluate statistical significance.

The first set of placebo regressions were for the growth rate of aggregated personal healthcare expenditures.[4] JSL reforms were randomly matched to state healthcare expenditure growth rates 1000 times to generate placebo standard errors. These standard errors were then used to compute new t-statistics and assign statistical significance. The placebo tests supported the results presented in section I.III. For individual healthcare spending growth, every coefficient that was statistically significant in section I.III was also statistically significant in the placebo tests. Moreover, the placebo tests generate statistically significant t-statistics for joint liability bans, acts

[4]The results of the placebo regressions are included in the Appendix. Table I.A3 presents the results associated with aggregated personal spending growth. Table I.A4 presents the results for Medicare spending growth per enrollee and Table I.A5 presents the results for Medicaid spending growth per enrollee.

in concert and fifty percent reforms. This suggests the standard errors from section III were generally too large.

The analysis was also run for Medicare and Medicaid per enrollee spending. The placebo tests generally confirm the results from section I.III. The Medicare placebo tests find statistical significance for every coefficient that was significant in section I.III. The Medicaid placebo tests were less clear-cut. The placebo test confirms the statistical significant of the intentional acts reform, but fails to confirm the statistical significance of the blameless plaintiff reform. Additionally, the placebo test generates a statistical significant t-statistic associated with the variable indicated a state had enacted any type of JSL reform.

I.VI. Discussion & Conclusion

This paper investigated whether different types of JSL tort reform were associated with decreased rates of healthcare spending growth. Previous authors (Avraham 2007; Avraham and Schanzenbach 2009; Avraham, Dafny and Schanzenbach 2010; Viscusi and Born 2005; Sloan and Shadle 2009) made the inference that decreasing malpractice payments and lower health insurance premiums were indicative of lower healthcare expenditures. My analysis shows that when all JSL reforms were combined into a single variable, there were significant negative effects on health care expenditures. However, this analysis also demonstrates different types of liability reform have different effects on healthcare expenditure growth. The JSL reforms based on the proportionality of liability have very meaningful and negative effects on the growth rate of physician and clinical service costs and the growth rate of hospital costs. Therefore, decreasing expenditure growth rates for clinical services and hospital services is likely to have a meaningful impact for consumers.

This paper demonstrates a causal relationship between ‘fair share’ reforms and slower growth in healthcare costs. “Fair share” types of reform seem to have significant effects across

most forms of expenditure growth rates, while JSL bans, intentional acts and acts in concert reforms seem to rarely affect growth rates. Additionally, the effects of "fair share" reforms were generally robust to placebo tests.

While there is evidence in this analysis that Medicaid spending growth can be decreased by implementing JSL reforms, the analysis is less robust. This may be a result of any number of factors biasing the estimates. Specifically, it is important to note that Medicaid is a state-run program and state reforms may have occurred simultaneously with JSL reforms in a manner such that the effects of JSL reforms could no longer be identified. Additional analyses demonstrated the complexity of interpreting the effects of different JSL reforms on Medicaid spending.

Additionally, it is possible the changes in disaggregated categories of medical spending may not represent actual decreases in the medical spending growth, but shifts among the categories of spending. This seems unlikely for total personal medical spending growth, as any types of spending growth were negatively affected by JSL reforms. However, this subject is much less clear for disaggregated categories of Medicaid spending growth. In some instances, the effect of JSL reform on personal, Medicare and Medicaid spending growth was positive and in some instances, the effect of JSL reform was negative. This could imply shifts between categories of spending, such as away from nursing home spending and toward home healthcare spending. Furthermore, shifts in spending could be a result of an unknown third factor.

Further research should investigate why JSL reforms seem to have different effects across per capita spending and government spending growth rates and different effects across different types of spending. This work suggests government healthcare spending growth must be addressed through policies other than joint several liability reform. Additionally, explaining why some

segments of medical spending growth are affected by tort reform and some are not may offer important insights into the mechanisms of healthcare spending and healthcare charges.

CHAPTER II

"EFFECTS OF INSURANCE STATUS ON EMERGENCY ROOM TREATMENT AND OUTCOMES."

II.I Introduction

After the passage of the Emergency Medical Treatment and Active Labor Act, hospitals who accept Medicare payments must also provide medical screening to any individual who requests and any emergent conditions must be stabilized, without regard to the patient's ability to pay or insurance status. This has resulted in emergency departments being used as insurers of last resort for patients without insurance. The intent of the law is to prevent hospitals from 'dumping' patients because of high anticipated treatment costs. This law may seem to imply that all patients reporting to the emergency room with similar conditions would experience similar treatment, regardless of insurance status. However, it is not clear whether emergency department patients are treated the same in emergency departments and whether differences in treatment patterns lead to differences in short term health outcomes.

Healthcare researchers have investigated differences in healthcare and mortality patterns across patients by insurance status; however, they face great difficulty in identifying causal relationships between insurance status and outcomes. Healthcare and treatment outcomes are influenced by a large number of unobserved and endogenous variables. Therefore, identifying the relationship between health insurance and health outcomes has been rather difficult. This paper uses a nationwide data set to answer three questions: (1) Do the results in Doyle's (2005) study of Wisconsin motor vehicle accident injuries hold for a nationwide sample; (2) Are the effects of health insurance on outcomes of motor vehicle accident injuries generalizable to other types of injuries; (3) Are the results in Doyle robust to overall health status?

Overall, I find Doyle's results are confirmed in a nationwide survey of motor vehicle accident injuries. Additionally, Doyle's findings are robust when controls for overall health

status apart from injury. Lastly, the effects of health insurance status on the outcomes of injuries not resulting from motor vehicle accidents are smaller in magnitude than the effects of health insurance status on motor vehicle accident injuries.

II.II Literature Review

According to Hadley's 2003 review of the literature, a quarter century of research about the relationship between insurance status, health status and health outcomes has involved dozens of studies. These studies have evaluated different diseases, different measures of care and outcomes, used different data sets and different methodologies. These results largely demonstrate individuals without insurance access less healthcare, but have a difficultly reaching conclusions about the causal relationship between receiving less healthcare and differences in health outcomes.

Unfortunately for researchers, the decision to purchase health insurance and the decision to seek medical treatment are generally considered to be endogenously determined with health outcomes. These identification challenges have made it difficult to confidently interpret the relationship between insurance status and healthcare outcomes. If healthy individuals are more likely to purchase health insurance and individuals with health insurance are more likely to seek medical treatment, then the outcome of treatment may appear to be related insurance status as a result of omitted variable bias. As a result, health researchers have used a number of creative and unusual methods to measure the relationship between insurance status and treatment outcomes.

For example, Braveman et al. (1994) investigates the likelihood that appendicitis progresses to a ruptured appendix as a function of insurance status. Braverman et al. (1994) assumes the risk of a ruptured appendix is approximately randomly assigned across individuals

and assigned independently from individual insurance status, the probability of a ruptured appendix is a good measure of access to care and treatment quality. If these assumptions hold and each individual is treated the same way, there should not be statistically significant differences among the probability of appendicle rupture across different types of insurance. However, using a California sample, Braveman et al. (1994) find uninsured patients and Medicaid patients are more likely to suffer from appendicle rupture than patients with private insurance.

More recently, studying patterns of care, costs and mortality rates for heart attack, stroke and pneumonia patients, Hasan, Orav and Hicks (2010) document that privately insured patients have mortality rates that were statistically significantly lower than uninsured and Medicaid patients (N=154,381). These results were robust to age and sex standardization, comorbidity controls and disease severity. Furthermore, patients with private insurance were associated with higher costs and higher resource demands, despite having shorter stays in the hospital than uninsured individuals.

However, several researchers have argued research about heart attack, pneumonia and similar conditions may be biased due to the complicated relationship between the factors that influence insurance choices and influence healthcare outcomes. As a result, researchers have attempted to correct for this bias by investigating the impacts of insurance status on trauma care and outcomes of trauma treatment by assuming that traumatic injuries are uncorrelated with health insurance status. In other words, researchers understand injuries as shocks to health status and randomly distributed across patients, regardless of the patient's insurance status. For example, Haas and Goldman (1994) created a sample of Massachusetts adult acute trauma patients (N=15,008) from emergency department patients to evaluate the impact of payer status

on difference in care and mortality rates. Uninsured patients with acute trauma were more likely to die, less likely to receive surgical care or physical therapy, and equally likely to be admitted to the intensive care unit compared to patients with private insurance. Medicaid patients were also less likely to receive surgical care but were no less likely to receive care in the intensive care unit or receive physical therapy and were no more likely to die.

Furthermore, Xiang et al. (2014) uses the 2010 NEDS to investigate the probability a severely injured individual is undertriaged (N=232,448). Undertriaged refers to situations where a patient's injuries are judged and treated as less severe than they really are. To do this, the authors restrict the sample to patients with an injury severity score greater than 16 for whom definitive emergency department care is observed. While 34% of the sample is undertriaged, Xiang finds no evidence the odds of undertriage increase for patients who are uninsured, receiving compensated care or have Medicaid coverage relative to individuals with private insurance. However, they do find probability of undertriage increases for individuals with Medicare coverage. Furthermore, it is unclear whether the probability of undertriage has any impact on the probability of mortality or the quality of care.

Lastly, Doyle (2005) uses severe car accidents in Wisconsin (N=10,842) as a health shocks to investigate the quality of treatment and health outcomes as a function of health insurance. This approach has the benefit of eliminating the selection bias associated with the decision to purchase health insurance and bias associated with the choice to go to the emergency department as ambulances are a routine member of the crash investigation team. Nevertheless, Doyle still demonstrates being uninsured has an impact on care and treatment outcomes. Doyle reports the uninsured receive 20% less treatment and have a mortality rate that is 1.5 percentage points higher than individuals with private insurance.

While Doyle's paper attempted to correct the bias associated with the endogeneity of having health insurance, it has some significant shortcomings. First, Doyle's paper uses a data set from a single state and it is not clear whether the results are generalizable to the national healthcare system. Second, Doyle investigates only motor vehicle accident injuries that were investigated by officials. While this decision does eliminate the individual's choice to present to the emergency department, it does strictly limit the generalizability of his results. Furthermore, injuries associated with motor vehicle accidents are primarily insured through automobile insurance and the results may not be an accurate measurement of the relationship between health insurance status and healthcare outcomes and patterns since those without health insurance could be covered by auto insurance. Lastly, Doyle has no method to control for the severity of underlying health conditions which may impact any patient's response to treatment and may impact the probability a patient has health insurance.

The current research builds on the Doyle's research by broadening the analysis to a national sample and considering other types of injuries. Additionally, using hospital administration records, I am able to explicitly control for health status using the Charleston comorbidity index (Charlson et al. 1987, Deyo et al. 1992, Quan et al. 2005). Lastly, this research compares the differences in treatment outcomes within the group of individuals characterized as uninsured by separating individuals who are uninsured but receiving charity care from uninsured individuals who are expected to pay out of pocket.

II.III Methodology

The samples were drawn from the 2006-2011 Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample. The first sample contains individuals over age 18

who were presented to the emergency department with an injury diagnosis coded as a motor vehicle accident. The second sample contains individuals over 18 who presented to the emergency department with a primary injury diagnosis, excluding those with an external injury code associated with a motor vehicle accident or terrorism. Each sample was also restricted to individuals with an injury severity score greater than five as an attempt to limit the examination to injuries which required medical attention. Additionally, each sample was limited to individuals with private health insurance, Medicare insurance, Medicaid insurance or were uninsured. Patients who reported other insurance, such as CHAMPVA, were categorized as "other." The diversity of payers included in the "other" variable would not allow for clear conclusions about the coefficient on this variable. Therefore, these patients were omitted from the current study. Uninsured patients could be further characterized as those who received charity care and those who did not.

The independent variables of interest were the dummy variables for payer status--private payer, Medicare, Medicaid, self-insurance or charity care. Additional control variables included in the regression were whether the hospital was a rural hospital, gender, age, year, and the median income for the patient's zip code. Age is a continuous variable from 18 to 100. The year variables were coded as dummy variables for 2006, 2007, 2008, 2009, 2010, 2011 and 2006 was used as the reference year. Median income categories were bracket one, from $1-38,999, bracket two from $39,000-47,999, bracket three from $48,000-63,999, and bracket 4 for income above $64,000 in 2011 dollars. The income category for above $64,000 was used as the reference category. Table II.1 presents descriptive statistics for the sample grouped by injury cause.

I also include variables to measure the severity of the injury and the overall health of the patient. First, to measure the overall health of the patient, I calculate the Charlson comorbidity

index.[5] The Charlson index is a measure of the ten year mortality probabilities developed by Charlson et al. (1987) and extended to newer coding systems by Deyo et al. (1992) and Quan (2005). The Charlson index assigns values from zero to six for seventeen different diagnosis codes and weights these values according to their mortality risk. The weighted values are then summed to create a single number measuring mortality risk. This was accomplished using the Charlson macro in STATA (Stagg 2015).[6]

Additionally, to measure the severity of the injury, I calculated the Injury Severity Score using STATA's ICDPIC program (Clark, Osler, & Hahn 2010). The Injury Severity Score is determined by assigning each injury an Abbreviated Injury Scale Score and a region of the body. Then the three most severely injured body regions and injuries are squared and summed to create the ISS. The ISS ranges from zero to seventy five. An ISS of seventy five is assigned to unsurvivable injuries. The descriptive statistics for the Charlson Index and the Injury Severity Score are presented in Table II.1.

The dependent variables included in the primary analyses were the probability of dying in the emergency room and the probability the patient was admitted to the hospital as an inpatient. Additionally, treatment intensity is measured by the number of procedures performed in the emergency department, number of procedures performed during the inpatient stay and the length of stay as an inpatient. Summary statistics for the dependent variables are presented in Table II.1 as well. Figures II.1-II.3 display the averages in dependent variables across payer groups.

[5] A similar measure, the Elixhauser comorbidity score was alternatively used to measure comorbidity. The results were unaffected.

[6] Charlson index values were calculated using both the Stagg, 2015 measure and the macro included in the ICDPIC program (Clark, Osler, & Hahn 2010). The results were unchanged.

Column six of Table II.1 presents the differences in the means between motor vehicle accident patients and patients with other types of injuries as well as indicating the statistical significance of these differences. However, it is important to note the sample is quite large and statistically significant differences may not be indicative of economically significant differences. That being said, there are some differences between the samples that are both statistically and economically significant. For example, motor vehicle accident injury patients are nearly twenty years younger than patients with another type of injury. Furthermore, there is a nearly forty percentage point difference in the probability of having private insurance between motor vehicle patients and patients with other types of injuries. At the same time, other injury patients are forty percentage points more likely to have Medicare. Lastly, before controlling for health condition or insurance status, patients with motor vehicle accident injuries are more likely to die in the emergency room, more likely to be admitted, undergo more procedures in the emergency department and the inpatient ward and experience longer stays as inpatients.

II.IV Estimates of the Effect of Payer Status on Emergency Room Disposition

For the analysis of outcome and disposition patterns, I use a logit regression. The specification is as follows:

$$Y_i = a_i + \beta_1 Medicare_i + \beta_2 Medicaid_i + \beta_3 Self\text{-}pay_i + \beta_4 Charity_i + \beta_5 X_i + \beta_3 T + \varepsilon_i \quad (1)$$

where Y_i is measures the probability of dying in the ED, probability of dying after admission, probability of being admitted and the probability of leaving the hospital against medical advice for record i. Additionally, *private insurance*$_i$, *Medicaid*$_i$, *Medicare*$_i$, *self-paying*$_i$, and *charity*$_i$ variables are dummy variables for the respective primary payer for record *i*. Private insurance is the reference variable. X_i is a vector of the control variables for observation *i*. As is traditional, ε_i

is the error term. Furthermore, standard errors and confidence intervals were adjusted to correct for hospital specific errors by clustering on the hospital. As the variables for the number of procedures and length of stay are continuous, an ordinary least squares specification was used for those outcomes employing the same independent variables in equation (1).

Table II.2 presents estimates of the marginal effects of insurance status on the outcome and disposition variables for patients presenting with an injury as a result of a motor vehicle accident and other injury results. The results in Table II.2, as well as all of the results in this section control for age, income category, gender, the Charlson comorbidity index, year, rural hospital, rural patient status, large urban area hospital and whether the hospital is a teaching hospital. Some results were expected. For example, Medicare patients are more likely to die in the emergency room and more likely to die after admission. Additionally, Medicare patients are more likely to be admitted to the hospital as an inpatient and more likely to leave against medical advice. Medicaid patient are also more likely to be admitted to the hospital patients and more likely to die after admission than privately insured.

However, some results indicate differences in outcomes that were not expected *a priori*. First, uninsured patients receiving charity care are not significantly different from privately insured patients with respect to death rates in the emergency department and the rate of admission. However, uninsured patients who do not receive charity care and therefore are paying out-of-pocket for healthcare costs are more likely to die in the emergency department, more likely to leave against medical advice and nearly nice percentage points less likely to be admitted to the hospital than privately insured patients.

Results for patients presenting with an injury not caused by a motor vehicle accident are

also shown below in Table II.2. Only self-paying patients are more likely to die in the emergency room than privately insured patients. Additionally, patients insured by Medicare, Medicaid and patients who are paying out of pocket are more likely to die after admission to the hospital. Medicare, Medicaid and charity patients are more likely to be admitted to the hospital; however, self-paying patients are again significantly less likely to be admitted to the hospital. Lastly, Medicaid patients, charity patients and self-paying patients are more likely to leave against medical advice relative to privately insured patients.

Furthermore, there are differential effects of insurance status on the probability of admission to the hospital. These results are presented in Table II.3. For motor vehicle injuries, Medicare and Medicaid patients are more than five percentage points more likely to be admitted to the hospital and patients paying out of pocket were nearly nine percentage points less likely to be admitted to the hospital relative to privately insured patients. However, there was no significant difference in the likelihood a privately insured patient and a patient receiving charity care were admitted after a motor vehicle accident.

When examining motor vehicle accident patients and patients with other types of injuries, there are some similarities. Medicare and Medicaid patients are still more likely to be admitted after suffering other types of injuries than privately insured patients. For patients paying out of pocket, the difference with privately insured patients has decreased, from nearly nine percentage points for motor vehicle injuries to being approximately 3.5 percentage points less likely to be admitted after other types of injuries. The largest difference between patients with motor vehicle accident injury and other types of injuries is the difference in admission probabilities for patients receiving charity care. While there was no statistically significant difference in admission probability for privately insured and charity care patients after motor vehicle accidents, charity

care patients with injuries from other causes are over 15 percentage points more likely to be admitted to the hospital than privately insured patients.

II.V Effects of Insurance Status on Treatment Patterns

Table II.4 compares the treatment patterns for patients who begin their visit through the emergency room with different primary payers. For motor vehicle injury patients, self-paying patients have a slightly shorter inpatient stay and receive fewer inpatient procedures. Unsurprisingly, Medicare patients have longer hospital stays than privately insured patients. It also seems reasonable that charity patients receive more procedures in the emergency department and fewer procedures after being admitted to the hospital. Lastly, Medicaid patients receive fewer emergency department procedures, stay in the hospital longer and receive a higher number of inpatient procedures than their privately insured counterparts.

Also in Table II.4, the results of the treatment pattern analysis for patients whose injury was not coded as being caused by a motor vehicle are shown. Again, Medicare patients tend to have longer inpatient stays, as do Medicaid patients, than privately insured counterparts. Medicaid patients tend to receive fewer procedures in the emergency department, but significantly more procedures as an inpatient. Also, as for motor vehicle accident injury patients, self-paying patients stayed in the hospital for less time and received fewer inpatient procedures that similar patients with private insurance.

II.VI Effects of Insurance Status on Patients over Age 65.

Due to the near universal coverage of individuals over the age of 65 and the significant difference in the average age for motor vehicle injury patients and patients with other types of injuries, I also analyze the effects of insurance status on injury treatment for patients under age

65. Table II.5 presents the descriptive statistics for motor vehicle accident and other injury patients and examines the statistical significance of the differences between the groups. As with the full sample, many of the differences between the two groups are statistically significant, but the differences are also somewhat smaller than for the full sample.

For individuals over the age of 65 with motor vehicle accident injury, self-paying patients are nearly one half a percentage point more likely to die in the emergency departments than privately insured patients as shown in Table II.6. Additionally, Medicaid patients were .08 percentage points less likely to die in the emergency department and there was no significant difference between the probability that privately insured and charity care patients died in the emergency room.

Also, in the case of injuries from causes other than motor vehicle accidents, there was no significant differences in the probability of death in the emergency department among privately insured patients, Medicare patients, Medicaid patients and patients receiving charity care. There was, however, an increased probability that uninsured patients paying out of pocket would die in the emergency department with respect to privately insured individuals.

Moreover, admission probabilities still vary by insurance status for patients under the age of 65. The marginal effects of insurance status on admission probabilities are presented in Table II.7. Regardless of the cause of injury, Medicaid and charity care patients are more likely to be admitted than privately insured patients. Uninsured patients expected to pay out of pocket are less likely to be admitted than privately insured patients. For injuries caused by motor vehicle injuries, there is no difference in the admission probability between Medicare patients and privately insured patients. On the other hand, for other types of injuries, Medicare patients are

over two percentage points more likely to be admitted than privately insured patients.

With respect to treatment patterns, Medicare patients with motor vehicle accident injures underwent more procedures in the emergency department, as did patients receiving charity care. These results are presented in Table II.8. Medicaid patients received fewer procedures in the emergency room, but underwent more procedures as inpatients and once admitted had longer inpatient stays than privately insured patients. However, similar patients paying out of pocket had shorter inpatient stays and underwent fewer inpatient procedures than privately insured patients. Patients receiving charity care also underwent fewer inpatient procedures, despite having longer inpatient stays than privately insured patients.

Patients with injuries resulting from causes other than motor vehicle accidents also demonstrate patterns of treatment that vary in a statistically significant manner with respect to insurance status. Medicare patients under 65 undergo more emergency department procedures and Medicaid patients undergo fewer procedures in the emergency department than do privately insured patients. The number of emergency department procedures performed for charity patients and patients paying out of pocket was not different from privately insured patients in a statistically significant manner. As with motor vehicle accident injuries, patients paying out of pocket had shorter inpatient stays than privately insured patients and Medicare and Medicaid patients had longer inpatient stays. Lastly, Medicare patients underwent fewer inpatient procedures and Medicaid patients underwent more inpatient procedures than did privately insured patients.

II.VII Discussion

These analyses add to the literature on payer status and emergency room treatment. The motor vehicle accident injury patients demonstrate patterns consistent with Doyle's earlier work. As Doyle found, uninsured patients are more likely to die in the emergency department, less likely to be admitted after a motor vehicle injury and spend less time in the hospital. Furthermore, the results from analyzing outcome and treatment patterns for patients with injuries from other causes also support this conclusion; however, the causes of traumatic injury vary across patients.

The predicted probability that privately insured patients with motor vehicle accident injuries die in the emergency department is .7% but uninsured patients have a 1.3% predicted probability dying in the emergency department, despite controlling for overall health and injury severity. However, for patients with injuries from other causes, the predicted probability that privately insured patients .2% of privately insured patients die in the emergency department while the predicted probability that uninsured patients die in the emergency department is .7%. Therefore, motor vehicle injury patients without any form of insurance are approximately twice as likely to die as similar patients with private health insurance. Patients with other types of injuries are over three times more likely to die in the emergency department if they are uninsured than patients with private insurance.

Furthermore, the additional probability of death in the emergency department for uninsured patients is not offset by an increase in the probability of death after admission for patients with private insurance. In other words, it is not the case that patients with private insurance are using more medical services, but end up experiencing similar outcomes. Instead, uninsured patients are more likely to die following both motor vehicle accidents and other types of injuries.

Differences between Charity Care and Self Paying Patients

This paper presents new results that indicate a need for further research beyond supporting Doyle's (2005) findings. First, among these are the results for patients receiving charity care from the hospital. This analysis demonstrates that although patients who are uninsured and pay out of pocket and patients who are uninsured but receive charity care experience different patterns of treatment and experience different patterns of outcomes. Patients receiving charity care are more likely to be admitted to the hospital than privately insured patients when the injury is not the result of a motor vehicle accident. However, for other measures of treatment and outcome, charity care patients receive similar treatment and have similar outcomes as do privately insured patients, regardless of the mechanism of injury.

Table II.9 presents the descriptive statistics comparing patients paying out of pocket and patients receiving charity care for both motor vehicle accident injuries and injuries from other causes. There are statistically significant differences between patients paying out of pocket and patients receiving charity care. For example, there are significant differences in the Charlson comorbidity scores, injury severity score and the proportion in the highest income group and the lowest income group. Patients paying out of pocket have slightly lower comorbidity scores and slightly lower injury severity scores regardless of whether the patient has been injured in a motor vehicle accident or has been injured in some other way. These patients are also more likely to be in the highest income group and are less likely to fall into the lowest income group. Lastly, patients paying out of pocket are more likely to be patients from a rural area and more likely to attend a rural hospital.

Furthermore, Table II.10 presents estimation results when the samples are limited to only patients receiving charity care and patients paying out of pocket. While there are no statistically differences in the probability of dying in the emergency department, patients paying out of pocket are significantly less likely to be admitted, spend fewer days as inpatients and receive fewer inpatient procedures relative to patients receiving charity care. Paying out of pocket is associated with a 21 percentage point decrease in the probability a patient with injuries from a motor vehicle accident is admitted to the hospital despite controlling for comorbidity and injury severity. For patients with injuries from causes other than motor vehicle accidents, they are 11 percentage points less likely to be admitted. As well as differences in admission rates associated with paying out of pocket. Patients paying out of pocket who were admitted with injuries form motor vehicle accidents had inpatient stays that were, on average, over two days shorter than uninsured patients receiving charity care.

Additionally, the results comparing Medicaid patients to privately insured patients raise further questions for research. Medicaid patients receive fewer procedures in the emergency department than privately insured patients, but are more likely to be admitted to the hospital, spend more time in the hospital after being admitted, and receive more inpatient procedures than privately insured patients. The differences between Medicaid patients and privately insured patients may be related to the differences in Medicaid reimbursement rates. However, because the current data set is nationwide and does not control for state, this study is insufficient to examine the causal mechanism for different types of treatment for Medicaid patients. Further research should examine whether the Medicaid results are driven by state level Medicaid policies or some other factor.

Unlike Doyle, this paper explicitly controls for health status and injury severity. Doyle attempts to solve both problems by assuming motor vehicle accident injuries are assigned independently of health insurance decisions and independently from the decision to seek medical attention. Doyle uses ambulance arrival or patient incapacitation to measure injury severity. However, this paper also assumes injuries are assigned randomly with respect to health insurance status, but also includes established controls for health status and injury severity.

Furthermore, this paper includes additional dependent variables to measure the treatment and outcome patterns. Doyle focuses on mortality, length of stay in the hospital and hospital charges. This paper uses two measures of mortality, mortality in the emergency department and mortality after admission to the hospital. Additionally, this paper uses length of stay, number of procedures performed in the emergency department and the number of procedures performed after admission to investigate the relationship between health insurance status and treatment patterns.

This paper extends and supports Doyle's conclusion that being uninsured is associated with less care and higher death rates resulting from motor vehicle injuries and other types of injuries. Uninsured patients are less likely to be admitted to the hospital and, once admitted, spend less time in the hospital and receive fewer procedures once they have been admitted. Furthermore, this paper also suggests there are other effects of insurance status and additional research to be undertaken. Uninsured patients receiving charity care do not have statistically significant mortality trends or statistically different patterns of treatment than privately insured patients. Lastly, Medicaid patients are admitted at higher rates than privately insured patients and appear to receive less treatment in the emergency department and more treatment as an inpatient

than privately insured patients. The effects of charity care and Medicaid status are topics for further investigation.

CHAPTER III.

“THE IMPACT OF HEALTH INSURANCE ON HEALTH ATTACK OUTCOMES.”

III.I Introduction

After the passage of the Emergency Medical Treatment and Active Labor Act, hospitals who accept Medicare payments must also provide medical screening to any individual who requests and stabilize any emergent conditions, without regard to the patient's ability to pay or insurance status. This law may seem to imply that all patients reporting to the emergency room with similar conditions would experience similar treatment, regardless of insurance status. However, it is not clear whether emergency department patients are treated the same in emergency departments and whether differences in treatment patterns lead to differences in short term health outcomes.

Healthcare researchers have investigated differences in healthcare and mortality patterns across patients by insurance status; however, they face great difficulty in identifying causal relationships between insurance status and outcomes. Healthcare, insurance status, and treatment outcomes are influenced by a large number of unobserved and endogenous variables. Health status likely indicates both the outcome of medical treatment and the decision to purchase health insurance. Whether an individual has insurance may also influence the decision to seek treatment and insurance may actually influence health status. These issues create several opportunities for endogeneity and make identifying the relationship between health insurance and health outcomes has been rather difficult. Taking advantage of increasingly large datasets and improvements in computing power, researchers have recently been able to do a more rigorous examination of the effect of health insurance on health outcomes.

III.II Literature Review

This paper contributes to the literature examining the relationship between a patient's medical condition and a patient's treatment. Health economists and epidemiologists have long been interested in the factors other than the patient's medical condition that influence treatment. For example, why do some patients get treatment in line with professional guidelines and some do not? Tsai et al. (2010) specifically investigate the degree to which acute myocardial infarction (AMI) patients in emergency departments receive treatment congruent with the American Council of Cardiology guidelines. They conclude there is only a low-to-moderate degree of compliance with such guidelines.

Health economists have investigated the relationship between physician characteristics, hospital characteristics, and financial incentives, and treatment decisions and patient outcomes. Obviously, these questions are quite difficult to analyze because of the number of unobservable and relevant variables and the challenge associated with satisfactorily identifying causal relationships. However, these challenges have not stopped research.

Early economic evaluation of treatment patterns with investigations of the decision to perform cesarean section delivery instead of vaginal delivery. These researchers could take advantage of timing, assuming time of delivery is distributed independently of the medical conditions of labor. This research is summarized in Keeler & Brodie (1993) who examine literature investigating the physician, hospital, insurer and maternal preferences influence the probability of cesarean delivery.

Later research, such as Gruber, Kim, and Mayzlin (1999) and Grant (2009), take advantage of changes in the Medicaid reimbursement rates between cesarean sections and vaginal deliveries as exogenous shocks. The medical condition of patients should not have

changed after the new rates, but new rates may induce the rate of cesarean section to change. Gruber, Kim and Mayzlin (1999) argue decreases in Medicaid reimbursement rates for cesarean births lead to fewer cesarean births. Grant (2009) replicates this work and also finds an effect, though smaller than Gruber, Kim, and Mayzlin, of reimbursement rates on treatment patterns.

Certainly, investigators would like to be able to investigate conditions other than labor and delivery. However, this does require either additional data, different identification strategies, or strong assumptions about the distribution of underlying health status. Some investigators, for example, Doyle (2005), address this limitation by considering only accident injury patients arriving at the emergency department by ambulance. Unfortunately, this research also finds controlling for the underlying patient condition or the severity of the patient's injury impossible given the particular data set.

Alternatively Braveman et al. (1994) investigates the likelihood that appendicitis progresses to a ruptured appendix as a function of insurance status. Braverman et al. (1994) assumes the risk of a ruptured appendix is approximately randomly assigned across individuals and assigned independently from individual insurance status, the probability of a ruptured appendix in the emergency department is a good measure of access to care and treatment quality. If these assumptions hold and each individual is treated the same way, there should not be statistically significant differences among the probability of appendicle rupture across different types of insurance. However, using a California sample, Braveman et al. (1994) find uninsured patients and Medicaid patients are more likely to suffer from appendicle rupture than patients with private insurance. However, it is possible insurance status affects individual's willingness to seek treatment which may affect the probability of a ruptured appendix in the emergency department.

More recently, studying patterns of care, costs and mortality rates for heart attack, stroke and pneumonia patients, Hasan, Orav and Hicks (2010) document that privately insured patients have mortality rates that were statistically significantly lower than uninsured and Medicaid patients (N=154,381). These results were robust to age and sex standardization, comorbidity controls and disease severity. Furthermore, patients with private insurance were associated with higher costs and higher resource demands, despite having shorter stays in the hospital than uninsured individuals.

Pezzin et al. (2007) also considers insurance status when investigating whether patients presenting with chest pain in the emergency department differ with respect the race and gender. However, this research uses only four diagnostic criteria to evaluate the appropriateness of treatment, strictly limiting the causal interpretation of this research.

Other medical and economic literature investigates the differences in treatment for patients with HMO insurance as opposed to fee-for-service insurance. For example Gaynor, Rebitzer, and Taylor (2004) consider the behavior of physicians in HMO programs in response to a new incentive structure at a specific HMO. They also show there is a statistically significant effect between financial incentives and the provision of services, but again are unable to observe individual patient treatment or the clinical nature of specific physician groups. Seddon et al. (2001) also focus on the differences between HMO and FFS insurance, but are limited in their causal interpretation.

As data sets became more complete and computing power decreased in costs, researchers have gained access to large, administrative datasets that include medical coding information for comorbidities, diagnoses, and specific procedure use. Several researchers have used the

additional data to construct propensity scores or indexes for patient condition. For example, Sada et al. (1998) uses the National Registry of Myocardial Infarction to construct a measure of appropriateness for intensive treatment and compares treatment and outcome patterns across FFS insurance, HMO insurance, Medicaid and uninsured patients. They demonstrate Medicaid patients have higher in-hospital mortality. Further, the likelihood of receiving angiography is significantly lower in HMO, Medicaid and uninsured patients. However, hospitals self-select into participation into the National Registry of Myocardial Infarction, suggesting the results may not represent average practice.

Currie, MacLeod and Van Parys (CMV) bring the use of patient appropriateness for intensive treatment to the health economics literature (2016). CMV uses a simple, but robust, measure of patient appropriateness for surgical treatment to investigate provider temperament and patient outcomes. While not addressing the relationship between insurance status and patient treatment, CMV's methodology is a significant step in being able to use administrative data sets and investigate patient treatment.

Here, I take advantage of the methodology developed in CMV to investigate the effects of insurance status on patient treatment and emergency department disposition. Despite the breadth of the existing literature, to my knowledge, this is the first paper to investigate the relationship between insurance status and the treatment patterns of acute myocardial infarctions in emergency departments after controlling for underlying health status.

III.III Data and Methodology

Data

The data is collected from the 2006-2011 Nationwide Emergency Department Sample from the Healthcare Cost and Utilization Project. The sample is limited to patients entering the emergency department with a primary diagnosis of an acute myocardial infarction, or heart attack, whose expected payer is private insurance, Medicare, Medicaid, paying out of pocket and who are not expected to be charged. Patients who had a primary payer of other, such as CHAMVA, were excluded from the sample. The diversity of payers included in the "other" variable would not allow for clear conclusions about the coefficient on this variable. Therefore, these patients were omitted from the current study. Uninsured patients could be further characterized as those who received charity care and those who did not.

It is important to understand what payer status means in the HCUP NEDS data sets. The HCUP NEDS is a data set collected from individual states that collect various types of information from hospitals using the national claims standard, known as the Uniform Bill (UB). The UB does not include an element for payer; thus, states have developed different classification processes to respond to the HCUP element "expected payer." Therefore, "expected payer" can be best understood as the entity that the hospital expects to pay for a service. "Expected payer" should not be interpreted to reflect who will eventually end up paying the bill, only who the hospital expects to pay the bill. However, expected payer does reflect how the hospital would infer insurance status during the patient's visit to the hospital.

Generally, state records are quite similar with respect to Medicare, Medicaid, private insurance and patients paying out of pocket. The hospital expects a given service will be paid for by Medicaid, private insurance or patients themselves, respectively. However, the other two categories for expected payer are less easily understood. First, visits categorized as having an expected payer of "no charge." In this paper, these visits are referred to as *charity care* patients.

These are visits for which the hospital does not expect to charge any individual or entity for the visit. These patients may or may not be indigent. The second category is the "other payer" category. Visits in the other payer category are expected to be paid by a variety of payers, including Tri-Care, the Indian Health Service, local and state indigency programs, and the Hill-Burton Act funds (Barrett et al. 2014; Barrett et al. 2015)

Additional control variables included in the regression were whether the hospital was a rural hospital, gender, age, year, and the median income for the patient's zip code. Age is a continuous variable from 30 to 90. The choice to eliminate patients under 30 follows Pezzin et al. (2007) and is an attempt to avoid the few outlier cases associated with congenital heart problems. Improvement in healthcare over time is controlled for by using dummies for discharge year and quarter. Income variables indicate the income quartile of the median income in a patient's zip code. Therefore, income variable does not measure the income of the individual patient, but the median income in her community.

I also include variables to measure the overall health of the patient by calculating the Charlson comorbidity index.[7] The Charlson index is a measure of the ten-year mortality probabilities developed by Charlson et al. (1987) and extended to newer coding systems by Deyo et al. (1992) and Quan (2005). The Charlson index assigns values from zero to six for seventeen different diagnosis codes and weights these values according to their mortality risk. The weighted values are then summed to create a single number measuring mortality risk. This was accomplished using the Charlson macro in STATA (Stagg 2015).[8]

[7] A similar measure, the Elixhauser comorbidity score was alternatively used to measure comorbidity. The results were unaffected.

[8] Charlson index values were calculated using both the Stagg, 2015 measure and the macro included in the ICDPIC program (Clark, Osler, & Hahn 2010). The differences in index values was insubstantial.

The dependent variables included in the primary analyses were the probability of dying in the emergency room and the probability the patient was admitted to the hospital as an inpatient. Additionally, treatment intensity is measured by the number of procedures performed in the emergency department, number of procedures performed during the inpatient stay and the length of stay as an inpatient. Summary statistics are presented in Table III.1. Further, in Table III.2, I present the descriptive statistics for patients according to their insurance status.

[Insert Table III.1 Here]

[Insert Table III.2 Here]

Methodology

The methodology used in this work is derived from Currie, MacLeod and Van Parys (2016). In this paper, Currie, MacLeod and Van Parys use a machine learning algorithm to estimate propensity scores to measure a patient's appropriateness for surgical treatment. Using propensity scores helps to eliminate concerns about endogeneity between independent variables of interest and dependent variables. This propensity score is designed to measure overall health status of a patient.

The first step in this methodology is to model the medical condition for each patient. I follow the approach presented by Currie, MacLeod and Van Parys (2016) and Currie and MacLeod (2016) and estimate the probability of a given outcome for AMI patients. This will be accomplished by estimating the following probit equation for the probability a patient receives a surgical procedure.

Pr(Intensive Procedure)=F(type of AMI, gender, age, dummy variables for comorbid conditions, Charlson Comorbidity score, year and discharge quarter dummies) (III.1)

Clearly, these propensity scores account only for observable variables. However, this measure will also reflect the effects of any unobserved variables insofar as unobserved variables vary systemically with the observed variables (Currie & MacLeod 2016). Additionally, the index is estimated using only privately insured patients at accredited teaching hospitals in hopes of capturing the current best practices and practices that are unaffected by insurance status.

Using the coefficients estimated in equations (III.1), I predict the propensity score for each patient in the sample as if he were treated as the average, privately insured patient at a teaching hospital. Next, I regress the estimated propensity score on the realized outcome in addition to controls. By doing this, I can estimate the effect of insurance status on an individual's probability of the following outcomes (Y_i): dying in the emergency room and admission into the hospital using the probit function. In all regressions, I cluster standard errors at the hospital-year pair level.

$$Y_i = \alpha_i + \beta^1{}_i(Medicare) + \beta^2{}_i(Medicaid) + \beta^3{}_i(Self\text{-}Pay) + \beta^4{}_i(Charity) + \gamma_i X_i + \delta_i\,(patient\ condition\ index)_i + \varepsilon_i \quad (III.2)$$

Additionally, I use negative binomial regression to estimate the relationship between insurance status and treatment patterns, the number of procedures in the emergency department, number of procedures as an inpatient and the length of stay in the hospital.

Lastly, to examine the effects of the Great Recession, I examine whether the relationship between insurance status and heart attack outcomes changes across pre-recession, recession and post-recession discharges using standard NBER quarterly dating for recessions. I regress

insurance status on the dependent variables for discharges before the beginning of the recession, discharges during the recession and discharges after the end of the recession. I then use simultaneous estimation to estimate a robust covariance matrix for hypothesis testing across the time periods.

III.IV Results

In this section, I present the results of the specifications described above. Table III.3 presents the mean patient condition scores, predicted using the estimates from equation 1 above conditional on health insurance status. Patient condition scores range from zero to one. For the individual patient, as the patient condition score goes to one, this indicates the patient is more likely to undergo surgical treatment. Charity patients are, on average, the most likely to undergo surgical treatment and Medicare patients are the least likely.

[Insert Table III.3 Here]

I next estimate the effects of insurance status on patient outcomes and treatment patterns conditional on the patient condition score. These results are presented in Table III.4 below.

[Insert Table III.4 Here]

However, because coefficients in logit and negative binomial models are difficult to interpret, I additionally calculate the marginal effects of health insurance. Table III.5 presents the marginal effects of health insurance status on mortality and admission probability.

[Insert Table III.5 Here]

Several results are notable. Patients with charity care are slightly less likely to die in the emergency department than privately insured patients, and patients paying out of pocket are

slightly more likely to die in the emergency department. However, the effects of health insurance status on admission probability are substantially larger. Patients paying out of pocket are nearly 1.5 percentage points less likely to be admitted relative to privately insured patients. Patients receiving charity care are nearly six percentage points more likely to be admitted. Both Medicare and Medicaid patients are more than one percentage point more likely to be admitted than privately insured patients.

Table III.5 also presents the marginal effects calculated from the negative binomial estimation results for the effects of health insurance status on the number of procedures performed in the emergency department, number of procedures performed as an inpatient and the length of inpatient stay.

With respect to treatment patterns, Medicare patients receive fewer emergency procedures and have a longer length of stay, nearly one half day longer, than privately insured patients. Medicaid patients receive fewer procedures in the emergency department and after admission and patients paying out of pocket receive fewer inpatient procedures and spend over one day longer in the hospital after admission. There is no significant difference between the effect of Medicare and Medicaid on the number of emergency department procedures. Charity care patients receive fewer procedures in the emergency department than privately insured patients, but more procedures after admission and, on average, remain in the hospital a half day longer than privately insured patients. Lastly, patients paying out of pocket receive fewer inpatient procedures, but stay slightly longer in the hospital after admission than their privately insured counterparts.

III.VI The Great Recession

Additionally, this data set includes the years before and after the Great Recession, which allows me to investigate whether the relationship between insurance status and emergency department behavior changes with a severe economic shock. I first estimate the patient condition index for patients before the recession, patients during the recession and patients after the recession. The time series of the patient condition index is presented in Figure III.1 for the full sample and by insurance status.

[Insert Figure III.1 Here]

Medicare patients are the least likely to undergo surgical treatment for the duration of the sample. And the average patient condition score for the full sample is dragged down from the Medicare patient condition score. The average score for Medicaid patients, self-pay patients, privately insured patients and charity care patients are higher than the overall average.

Using the NBER dating for recession, the prerecession data comes from discharges before the third quarter of 2007 and the post-recession data comes from discharges after the second quarter of 2009. Table 6 presents the marginal effects of insurance status on the probability of fatality in the emergency department, probability of admission, number of procedures performed in the emergency department, number of inpatient procedures, and the length of the hospital stay before, during and after the Great Recession. Table III.6 also includes the differences in the marginal effects between the pre-recession time period and the recession discharges, the recession discharges and post-recession discharges, and the difference between pre-recession discharges and post-recession discharges.

[Insert Table III.6 Here]

First, the most striking result is the relationship between admission probability, patients receiving charity care and the recession. Before the recession, patients receiving charity care were approximately two percentage points more likely to be admitted than privately insured patients; however, after the recession, these patients were more than thirteen percentage points more likely to be admitted. This difference is both statistically significant and economically interesting. It appears most of this difference, over eight percentage points occurred between the recession and post-recession discharges.

In fact, the relationship between charity care and patient treatment seems to be the most affected by the recession. Charity care patients become significantly less likely to die after the recession, more likely more likely to be admitted and receive fewer procedures in the emergency room. In fact, before the recession there is no statistically significant difference in the probability of death in the emergency department between charity care patients and privately insured patients, but after the recession, charity care patients are approximately one percentage point less likely to die in the emergency room than privately insured patients.

Patients receiving charity care also undergo fewer procedures as inpatients and spend less time in the hospital after the recession than they did before the recession. Additionally, the differences between the effect of charity care before the recession and during the recession are never statistically significant. Furthermore, the differences between charity discharges during the recession and after the recession are always statistically significant.

Additionally, the effects of being an uninsured patient who does not receive charity care are relatively unaffected by the recession. Discharges after the recession were only statistically

significant from discharges after the recession in the case of procedures performed in the emergency department.

Medicare and Medicaid patients seemed to have less predictable results. The relationship between Medicare and Medicaid insurance status with the probability of death in the emergency department is unaffected by the recession and the relationship between Medicare on the probability of admission are also unaffected by the recession. However, Medicaid insurance status and probability of admission increase by over one percentage point between the pre-recession discharges and recession discharges. There is no difference between the probability of admission during the recession and the post-recession for Medicaid patients.

Furthermore, the relationship between Medicare insurance status and the number of inpatient procedures performed is also statistically different between pre-recession discharges and recession discharges and recession discharges and post-recession discharges. However, there is no statistically significant difference in the relationship between Medicare insurance and the number of inpatient procedures across pre-recession and post-recession discharges. In fact, the increase in the number of inpatient procedures between the pre-recession period and the recession period is exactly undone by the decrease between the recession and post-recession period. The relationship between Medicaid insurance status and the number of inpatient procedures is also statistically unchanged across the pre-recession, recession, and post-recession discharges.

Lastly, the length of inpatient stays for Medicare patients are affected by the Great Recession. For Medicare patients, the relationship between Medicare insurance and inpatient length of stay increases from lengths of stay 0.4 days longer than private patients during the pre-

recession period to one half day longer than privately insured patients during the recession. Again, this effect is essentially erased between the recession and post-recession time periods.

III.VII Alternative Measures of Patient Condition

One concern with this type of research is the concern that the index of patient condition does not capture the relevant health information. Therefore, as a robustness exercise, I repeat the above analysis using a patient index based on the probability of fatality. Table III.7 contains the estimates for the average patient condition score using the alternate estimation. Figure III.2 presents the time series of the alternate patient condition score for the full sample and by insurance status.

[Insert Table III.7 Here]

[Insert Figure III.2 Here]

The results for the analysis using the alternate measure of patient conditions are presented in table III.8 below.

[Insert Table III.8 Here]

The pattern of statistically significant effects of insurance status and significant differences across pre-recession, recession and post-recession time periods are very similar to the results using the initial formulation of patient condition. There are a few differences to note, however. First, the effect of paying out of pocket on the likelihood of admission decreases by 0.7 a percentage points; paying out of pocket is associated with being 1.79 percentage points less likely to be admitted before the recession to being 1.05 percentage point less likely to be admitted after the recession with respect to similar, privately insured patients.

There is even less difference between the two analyses for the number of emergency department procedures and inpatient procedures. For the number of emergency department procedures, Medicare patients receive .019 fewer procedures after the recession than during the recession. Once again, charity patients and patients paying out of pocket receive fewer procedures in the emergency department after the recession than during the recession. Patients receiving charity care also receive fewer procedures after the recession then they did before the recession.

With respect to inpatient procedures, Medicare patients receive .175 more procedures during the recession than before the recession and receive .18 fewer procedures after the recession than during the recession. Again, the effect of the recession does not extend beyond the recession. Charity patients, however, receive .5 fewer procedures after the recession than during the recession. Lastly, for the length of stay analysis, charity care patients again see a decrease in their length of stay of .7 days between the recession and post-recession time periods.

III.VIII Patients Aged under 65

As an additional robustness exercise, it is common in the literature investigating the relationships between insurance status and patient outcomes to limit the sample to patients under the age of 65 because patients over 65 are universally covered by Medicare. However, there are patients in the dataset who are under 65, but still covered by Medicare. Furthermore, by excluding individuals over 65, the differences in age across insurance status are substantially reduced. In this analysis, the patient condition index is the same index used in the first analysis. These results are presented below in Table III.9.

[Insert Table III.9 Here]

Once again, charity care is associated with large differences in the probability of death and the probability of admission across the recession time periods. Charity patients are nearly 1.5 percentage points less likely to die in the emergency department after the recession than before the recession. Most of this change occurred between the recession and post-recession time period, 1.3 percentage points. Similarly, charity patients became over nine percentage points more likely to be admitted to the hospital between the recession discharges and post-recession discharges. There was an even larger change between pre-recession discharges and post-recession discharges, over eleven percentage points. During these same time periods, charity patients received fewer emergency department procedures, fewer inpatient procedures and shorter lengths of stay relative to privately insured patients.

In addition to the relationship between the charity care provision and the recession, there are a few effects of the recession on outcomes and treatment for Medicare and Medicaid patients. Medicaid patients became more likely to be admitted relative to privately insured patients between pre-recession and recession discharges and between pre-recession and post-recession discharges. Not unexpectedly, this is coincident with an increase in the number of inpatient procedures between the pre-recession and post-recession time period. However, there is also an increase in the number of inpatient procedures for Medicaid discharges between the recession and post-recession time periods. On the other hand, the Medicare discharges spend relatively more days in the hospital from the pre-recession to recession discharges and relatively fewer days between the recession and post-recession discharges.

III.IX Discussion

Given the results above, the questions arises “Why does the recession significantly affect the relationship between insurance status and treatment patterns and outcomes?” There are some significant differences in the sample across time periods. For example, patients living in wealthier areas before the recession and patients before the recession and during the recession are older than patients after the recession.

Perhaps of more consequence, there are differences in the patient condition index across time periods. For the patient condition index based on the probability of surgical intervention, both pre-recession discharges and recession discharges were lower than the patient index after the recession. When using the index based on the probability of death, pre-recession discharges had a lower index than did discharges during the recession and discharges after the recession. This index was also significantly lower for patients during the recession than for patients after the recession.

Unfortunately, none of these differences seem large enough or reliable enough to explain the changes in treatment patterns and outcomes. Furthermore, the changes observed in the relationship between insurance status and treatment outcomes are not easily condensed into a single phenomenon, all but guaranteeing the causal factors to be numerous and complicated. However, by focusing on individual changes in effects, perhaps we can gain more insight into the way recessions affect healthcare.

Specifically, why is the relationship between charity care and treatment patterns between the recession and post-recession time periods and between pre-recession and post-recession discharges? The effect of charity care is significantly different between pre-recession and post-recession discharges is exceptionally robust to specification and sample and with respect to every

dependent variable. The effect of charity care is also significantly different between recession and post-recession discharges regardless of the patient condition index, the sample and the outcome variable. The question, then, is what is driving these differences. Using the HCUP data, I can examine how patients receiving charity care may vary across pre-recession, recession, and post-recession discharges.

Charity Care

For patients receiving charity care, there are systemic and robust changes to the effects of insurance status on treatment patterns. Most notably, the effect of charity care on the probability of admission increased by double digits in every specification. Is there anything in the set of charity care patients that might be driving this change?

First, it is notable that, as a percentage of the sample, charity care was more prevalent before the recession than during the recession and after the recession, despite the fact patients were, on average, living in wealthier neighborhoods before the recession. Additionally, when examining only patients receiving compensated care, the only significant difference in the income variable is between pre-recession and recession discharges. There is no significant difference between recession and post-recession discharges or pre-recession and post-recession discharges. Therefore, income changes are unlikely to be the cause of the change in the probability of admission as the change in admission probability seems to occur between recession and post-recession discharges.

There are interesting relationships between age and discharges across recession time periods. First, among all patients receiving charity care, there is no difference in the average age across all time periods. However, because age is significantly and negatively correlated with the

probability of receiving compensated care and because Medicare covers all patients over the age of 65, examining the distribution of age among patients receiving compensated care when limiting patients to under the age of 65. In this case, patients presenting to the emergency department before the recession are significantly younger than patients presenting during the recession and are significantly younger than patients presenting after the recession.

Additionally, when limiting the sample to patients receiving compensated care and under the age of 65, the patient index based on the probability of surgical intervention is larger in the recession and post-recession time periods. If physician willingness to perform surgical interventions increases over time, then the need for hospital admission may also increase. Moreover, surgical interventions are likely to dramatically increase hospital charges, which may increase the degree to which patients would qualify for charity care.

Lastly, the index based on the probability of death is larger in the pre-recession period than in the recession period. This may contribute to changes in the rates of admission. Furthermore, the analyses above demonstrate charity care patients are significantly less likely to die in the emergency department after the recession than before the recession. The increased survival could explain increased effect on admission rates.

However, the differences in the patients receiving charity care across the pre-recession, recession, and post-recession time periods are generally unsatisfying explanations of the changes in the relationship between insurance status and treatment patterns. While there are significant differences in the patients across time periods, the magnitude of these differences seem to be insufficient to explain some of the large changes in effect size associated with different time periods.

This work illustrates the large and dynamic relationship between charity care, patient outcomes and treatment patterns. The nature of the charity care indicator variable is an indicator that the hospital does not expect to receive compensation for the care provided. Unfortunately, because the expectations are formed at the hospital level, the paper is insufficient to understand how the expectations are formed. Furthermore, this decision is largely a black box to researchers. We know hospitals provide care for no compensation, but there is almost no research about the determining factors for charity care at the hospital level.

However, some research has been done to describe the characteristics of patients who receive uncompensated care and the types of hospitals that provide more uncompensated care. However, there is an important difference between uncompensated care and charity care in the NEDS data. Generally, research on uncompensated care uses financial records and includes both charity care and bad debt. Bad debt are the charges that have not yet been paid, but the hospital still expects that they will be paid. Charity care is care the hospital does not expect to paid for at any point.

Saywell et al. (1989) present a description of Indiana uncompensated care, from both the patient perspective and the hospital perspective. Patients who receive uncompensated care were primarily single, 54% of the sample, and female, 61%. Additionally, only 44.6% of patients who received uncompensated care in the sample were uninsured; 46.8% of the insured patients had some form of commercial insurance which covered some of the costs. The size of the uncompensated care for each patient is below $5000 for 87.2% of the sample and 40% was under $500. Lastly, the hospitals providing uncompensated care was provided were majority small, 57%, and rural hospitals, 50%. However, most of the uncompensated care cases above $5000.00 were in large, urban hospitals.

We also know increased competitive pressure decreases the amount of uncompensated care provided. Mann et al. (1995) demonstrate the hospitals who feel more competitive pressure from the expansion of managed care organizations provide less uncompensated care than other California hospitals. Additionally, Thorpe, Florence and Seiber (2000) use a sample of AHA hospitals from 1990 to 1997 to show ownership status and conversions in ownership status affects the amount of uncompensated care provided. In public teaching hospitals, uncompensated care comprises 17.6% of expenses; in not for profit and for profit hospitals, uncompensated care comprises 4.6% and 4% of expenditures respectively. Furthermore, hospitals that convert from public and not for profit status to for profit ownership decreases the amount of uncompensated care provided. Lastly, Choi and Chang (2007) show larger amounts of charity care are associated with larger profit margins for private hospitals, but are associated with smaller profit margins for public hospitals.

Unfortunately, none of this research speaks directly to the question of why some patients receive charity care and some do not. Nor does any of the existing research speak to why charity care patients are more likely to be admitted or less likely to die in the emergency department. This question remains open for further research.

Affordable Care and Patient Protection Act of 2010

An addition factor confounding the interpretation of the effects of the recession on patient outcomes and patterns of treatment is the passage of the Patient Protection and Affordable Care Act (ACA). The massive healthcare reform law was passed and signed into law between December of 2009 and March of 2010 and is intended to reform healthcare financing, health insurance, and the provision of healthcare in substantial ways (Summary of the Affordable Care

Act 2013). Unfortunately, the passage of the law is nearly coincident with the end of the Great Recession.

Despite the ACA being enacted March, 2010, the provisions of the ACA were not scheduled to take effect immediately. Different provisions were intended to take effect in different years. Very few provisions took effect in 2010 and 2011, making the direct effect of the ACA on the impacts of insurance status unlikely. However, hospitals may have changed their behavior in anticipation of provisions taking place in the future. Unfortunately, the data used in this paper extend only to the fourth quarter of 2011, making examining the long-term effects of insurance on treatment patterns and patient outcomes. Specifically, an effect associated with the end of the recession may be expected to fade as the end of the recession recedes farther into the past; effects associated with the ACA may be expected to remain constant, or potentially increase, into the future.

The effect of charity care on patient outcome and treatment was the most notable result presented in this paper, especially the large and robust increase in the effect of receiving charity care on the probability of admission. The time series behavior of admissions by insurance status is presented below in Figure III.3.

[Insert Figure III.3 Here]

In Figure III.4, the time series behavior of charity admissions is plotted alone to better display the degree of change.

[Insert Figure III.4 Here]

Over time, relative to the total number of admissions, charity admissions is small and seems to remain relatively constant. However, in absolute terms, the number of charity admissions increases greatly from the first quarter of 2010 to the second quarter of 2010. This closely tracks the timing of the ACA, but may also reflect a lagged effect of the recession.

Further research is necessary to parse the effects of the recession from the effects of the ACA. However, in this work, it is clear admission behavior changed between the fourth quarter of 2009 and the second quarter of 2010. Most significantly, the effect of charity care on the probability of admission increased nearly ten percentage points. However, the total number of admissions increased, the number of privately insured admissions and the number of Medicare admissions also increased substantially during the same period.

III.X Conclusions

This paper examines the effects of insurance status on treatment patterns and patient outcomes for patients with acute myocardial infarction presenting to hospital emergency departments. I show there are numerous significant differences between insurance status and patient outcomes using a novel technique for controlling for patient condition developed in Currie, MacLeod, and Van Parys (2016). Additionally, the work demonstrates there are meaningful and robust changes in these relationships across the recent Great Recession. Most notably, the probability a patient receiving charity care and the probability of hospital admission increases by several percentage points between the recession period and the post-recession period.

This work leaves open the question of the exact mechanism of the relationship of insurance status and treatment patterns, whether the effect is driven by hospital behavior,

physician behavior, or patient behavior. It does, however, provide substantial evidence the relationship is not driven by the underlying patient condition. Furthermore, the work does not answer the question of why the recession meaningfully changes the relationships between insurance status and outcome variables. Additionally, the paper considers the possible effects of the ACA on admission behavior and leaves open several avenues for further research.

Lastly, this paper demonstrates large and robust differences in outcome and treatment between patients who receive charity care and similar patients with different expected payers. Unfortunately, this paper is unable to answer why these differences exist and how hospitals make decisions to offer services at no charge. In further research, the author expects to address these concerns.

TABLES AND FIGURES.

I. Tables and Figures, Chapter I

Table I.1. Descriptive Statistics.				
	Mean	Standard Deviation	Minimum	Maximum
% Change in Per Capita Healthcare Expenditures	5.752	1.954	-0.00982	13.15
% Change in Per Capita Nursing Home Expenditures	4.842	3.624	-7.135	20.84
% Change in Per Capita Hospital Expenditures	5.419	3.032	-4.863	15.46
% Change in Per Capita Home Healthcare Expenditures	4.623	10.36	-29.96	84.38
% Change in Per Capita Physician Expenditures	5.428	3.839	-7.463	19.76
% Change in proportion of population uninsured	0.996	12.37	-48.96	46.77
% Change in Per Capita Community Hospital Beds	-1.274	4.161	-40.13	44.06
% Change in African American proportion of the population	2.355	30.55	-33.61	775.2
% Change in Female proportion of the population	-0.0541	0.188	-1.565	1.598
% Change in Over 65 proportion of the population	0.295	1.086	-6.833	4.605
% Change in Bad Health Index	2.539	9.777	-26.89	44.45

% Change in Real Income	5.799	3.960	-12.84	16.34

Table I.2. Regression 1.	
VARIABLES	COEFFICIENTS
Growth in BHI	-0.005
	(0.006)
Growth in Uninsurance Rate	-0.003
	(0.004)
Growth in Community Hospital Beds per Capita	0.032
	(0.031)
Growth in the proportion of population that is African American	-0.001***
	(0.000)
Growth in the proportion of population that is female	-0.584
	(0.500)
Growth in real income	0.088**
	(0.040)
Growth in the proportion of population that is over 65	0.079
	(0.095)
Joint and Several Liability Reform	-0.477**
	(0.187)

a. Dependent variable is percentage growth rate in per capita healthcare expenditures.
b. Standard errors clustered by state in parentheses.
c. * .1 significance, **.05 significance, ***.01 significance.

Table I.3.Per Capita Expenditure Growth					
	Aggregate	Hospital	Home Health	Nursing Home	Physician
JSL	-0.477**	-0.117	-0.799	-0.404	-1.351**
	(0.187)	(0.596)	(4.105)	(0.612)	(0.570)
Ban	-0.396	-0.456	0.493	0.299	-0.456
	(0.330)	(0.469)	(5.429)	(1.047)	(1.413)
Intent	-0.097	1.051***	-2.053	-0.814	-2.192***
	(0.233)	(0.279)	(1.750)	(0.599)	(0.737)
Concert	-0.671	-1.034	5.300**	-1.179***	-0.030
	(0.651)	(1.182)	(2.355)	(0.371)	(0.487)
Fifty	-0.394	-0.266	3.447*	-1.233*	-0.041
	(0.404)	(0.662)	(1.816)	(0.625)	(0.579)
Blameless	-0.421***	1.196***	-2.946***	-0.184	-1.317***
	(0.147)	(0.176)	(0.858)	(0.332)	(0.270)
Greater	-1.188***	-2.085***	-1.394	-2.050***	-0.964***
	(0.154)	(0.166)	(0.869)	(0.304)	(0.251)
Any	-1.043***	-0.647	2.429	-1.846**	-0.541
	(0.282)	(0.914)	(1.918)	(0.753)	(0.756)

a. Dependent variable is percentage growth rate in per capita healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for state-level changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Table I.4. Medicare per Enrollee Expenditure Growth					
	Aggregate	Hospital	Home Health	Nursing Home	Physician
JSL	-0.570**	-0.208	0.945	-0.355	2.390
	(0.257)	(0.335)	(1.706)	(0.406)	(1.915)
Ban	-2.227*	1.695*	-7.706**	-2.738	-3.290
	(1.228)	(0.881)	(3.089)	(2.156)	(4.361)
Intent	0.125	-0.064	0.449	0.285	-1.036
	(0.798)	(0.400)	(2.752)	(0.677)	(1.141)
Concert	-0.290	-0.713***	-2.989***	0.102	-4.330***
	(1.163)	(0.213)	(0.800)	(1.454)	(0.992)
Fifty	-0.259	-1.036***	0.798	-0.320	-1.026
	(0.432)	(0.340)	(1.628)	(0.485)	(1.192)
Blameless	-1.331***	0.147	-8.880***	0.118	-3.312***
	(0.181)	(0.227)	(0.801)	(0.190)	(0.692)
Greater	-0.832***	0.364	2.763***	-0.791***	-2.718***
	(0.164)	(0.324)	(0.689)	(0.200)	(0.672)
Any	-0.861*	-0.836**	0.712	-0.463	-2.089
	(0.433)	(0.364)	(1.975)	(0.567)	(1.426)

a. Dependent variable is percentage growth rate in per Medicare enrollee healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Table I.5. Per Medicaid Enrollee Expenditure Growth					
	Aggregate	Hospital	Home Health	Nursing Home	Physician
JSL	1.496	3.728	7.360	0.726	-1.226
	(1.739)	(4.106)	(8.031)	(1.373)	(3.525)
Ban	1.276	2.133	-6.817	-1.478	4.686
	(1.791)	(3.200)	(6.252)	(2.229)	(4.285)
Intent	-2.638**	-0.052	-10.089	0.376	-10.892***
	(1.173)	(10.388)	(6.493)	(1.349)	(2.876)
Concert	-0.870	-2.119	2.680	-2.939	11.237
	(1.217)	(2.420)	(2.743)	(2.599)	(11.195)
Fifty	0.179	-1.446	4.676	-0.245	-0.924
	(1.527)	(1.536)	(9.834)	(2.072)	(3.119)
Blameless	-1.851***	-4.826***	13.804***	-4.580***	-1.092
	(0.666)	(1.015)	(2.920)	(0.956)	(1.222)
Greater	-0.166	1.531	1.586	0.893	-3.473***
	(0.665)	(1.108)	(2.625)	(1.006)	(1.171)
Any	-0.524	-2.616	15.695	-0.157	-2.297
	(2.384)	(1.790)	(11.977)	(3.060)	(4.903)

a. Dependent variable is percentage growth rate in per Medicaid enrollee healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Table I.6. Leads for Aggregate Per Capita Expenditure Growth.

	JSL	JSL Ban	Intentional Acts	Acts in Concert	JSL-Fifty Percent	Any Greater Liability
First Lead	0.083	1.189***	0.326	-1.185***	-0.007	0.037
	(0.473)	(0.232)	(0.924)	(0.437)	(0.870)	(0.644)
Second Lead	1.030**	0.761	1.961**	0.344	0.034	-0.587
	(0.445)	(1.672)	(0.794)	(0.439)	(0.785)	(0.713)
Third Lead	0.207	1.623**	1.578***	0.662	0.420	0.269
	(0.446)	(0.661)	(0.327)	(0.451)	(0.678)	(0.523)

a. Dependent variable is percentage growth rate in aggregateper capita healthcare expenditures. Standard errors, in parentheses are corrected by clustering at the state level.
b. * .1 significance, **.05 significance, ***.01 significance.
c. Controls for changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Table I.7. Leads for Aggregate Per Enrollee Medicare Spending.						
	JSL	JSL Ban	Intentional Acts	Acts in Concert	JSL-Fifty Percent	Any Greater Liability
First Lead	-0.512*	-2.886*	-0.767	0.447	-0.297	-1.039**
	(0.279)	(1.614)	(0.606)	(1.510)	(0.672)	(0.430)
Second Lead	0.294	-2.605*	-2.737**	2.170	0.097	-0.422
	(0.632)	(1.364)	(1.188)	(1.326)	(1.419)	(1.171)
Third Lead	1.124*	1.335	-0.849***	2.151**	0.209	-0.232
	(0.636)	(1.059)	(0.240)	(0.814)	(1.034)	(0.794)

a. Dependent variable is percentage growth rate in aggregate per Medicare enrollee healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

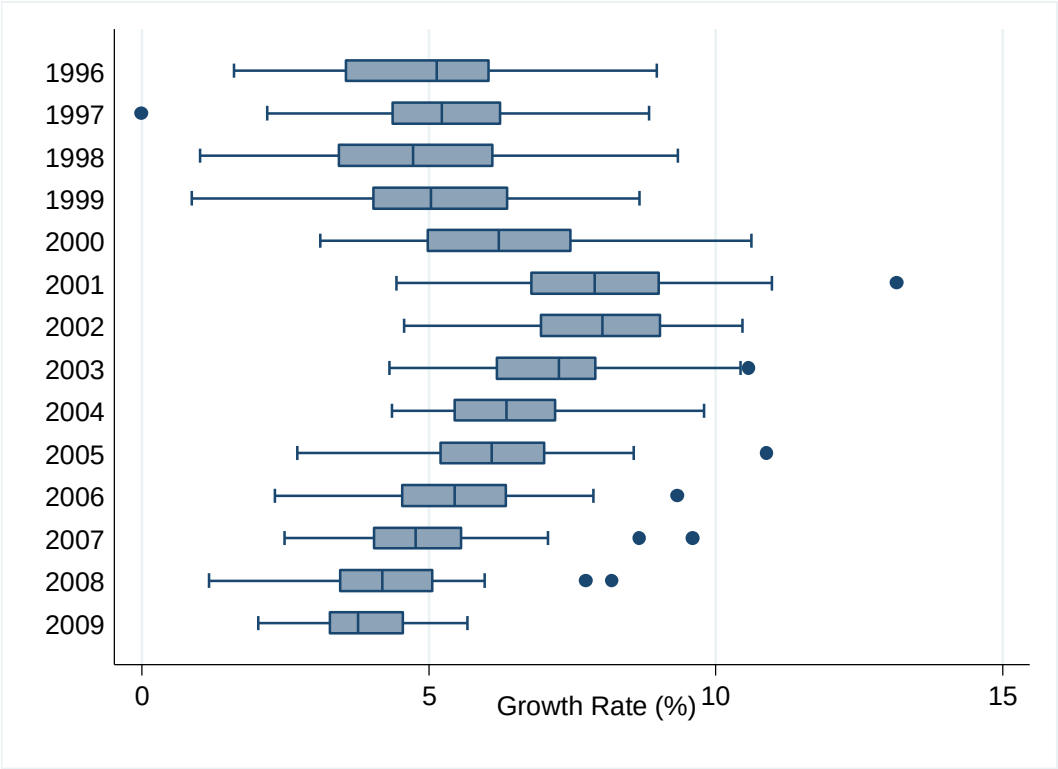
Table I.8. Leads for Aggregate Per Enrollee Medicaid Spending.						
	JSL	JSL Ban	Intentional Acts	Acts in Concert	JSL-Fifty Percent	Any Greater Liability
First Lead	1.485	-0.308	-1.001	0.631	1.864	0.390
	(2.031)	(0.829)	(3.684)	(0.922)	(2.229)	(2.708)
Second Lead	-0.376	2.973	1.251	4.534	5.696	1.546
	(2.624)	(8.553)	(4.575)	(3.912)	(4.310)	(4.040)
Third Lead	1.434	-5.919**	2.550	2.741	-0.291	-0.065
	(2.631)	(2.587)	(6.559)	(1.774)	(2.942)	(3.060)

a. Dependent variable is percentage growth rate in aggregate per Medicaid enrollee healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Figure I.1. Growth Rates of Personal Healthcare Expenditures



II. Tables and Figures, Chapter II

Table II.1. Descriptive Statistics, Full Sample			
Variables	Motor Vehicle Accident Injury (Standard Deviation)	Other Injury (Standard Deviation)	Differences
Age	41.32 (18.15)	60.55 (23.39)	-19.24***
Weekend Admit	33.1 (47.1)	31.1 (46.3)	2.02***
Female	39.9 (49.0)	56.1 (49.6)	-16.1***
Charlson Index	0.169 (0.455)	0.453 (0.725)	-0.284***
Injury Severity	11.88 (8.229)	9.789 (4.778)	2.090***
Rural Patient	7.96 (27.1)	7.47 (26.3)	0.492***
Rural Hospital	4.90 (21.6)	6.13 (24.0)	-1.22***
Metro Patient	24.5 (43.0)	25.2 (43.4)	-0.762***
Metro Hospital	86.1 (34.6)	82.4 (38.1)	3.65***
Teaching Hosp.	38.8	33.9	13.7***

	(48.7)	(47.3)	
Medicare	11.0 (31.3)	51.3 (50.0)	-40.3***
Medicaid	9.10 (28.8)	9.64 (29.5)	-0.539***
Private Ins.	60.8 (48.8)	24.1 (42.8)	36.7***
Self-Pay	21.8 (41.3)	14.6 (35.3)	7.17***
Charity Care	0.702 (8.35)	0.744 (8.59)	-0.0417*
South	46.9 (49.9)	42.2 (49.4)	4.71***
Not South	53.1 (49.9)	57.8 (49.4)	-4.71***
Income 1	27.3 (44.5)	26.7 (44.2)	0.610***
Income 2	27.1 (44.5)	26.1 (43.9)	1.05***
Income 3	23.8 (42.6)	23.6 (42.4)	0.212*
Income 4	18.8 (39.1)	21.2 (40.9)	-2.40***
Death in ED	0.889	0.205	0.684***

	(9.39)	(4.52)	
Admission Rate	43.9 (49.6)	42.3 (49.4)	1.59***
# ED Procedures	1.036 (2.175)	0.833 (1.534)	0.203***
IP Stay Length	7.595 (11.46)	5.966 (6.984)	1.629***
# IP Procedures	3.476 (4.002)	1.951 (2.213)	1.525***

Figure II.1. ED Fatality Rate by Payer

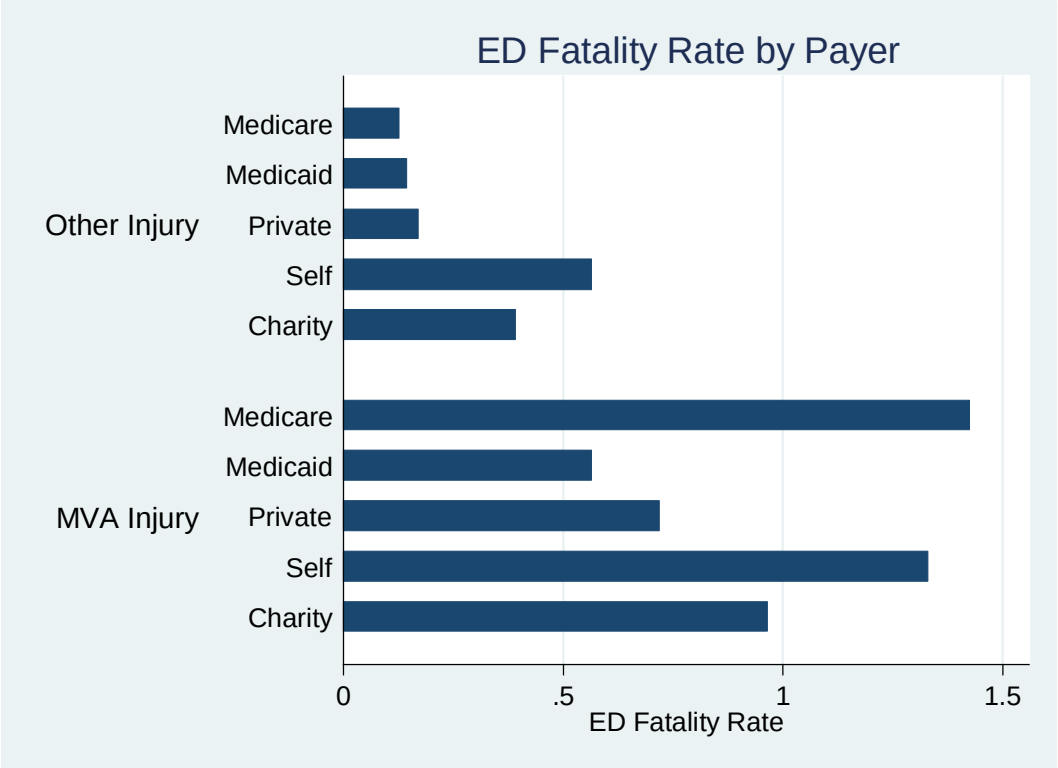


Figure II.2.

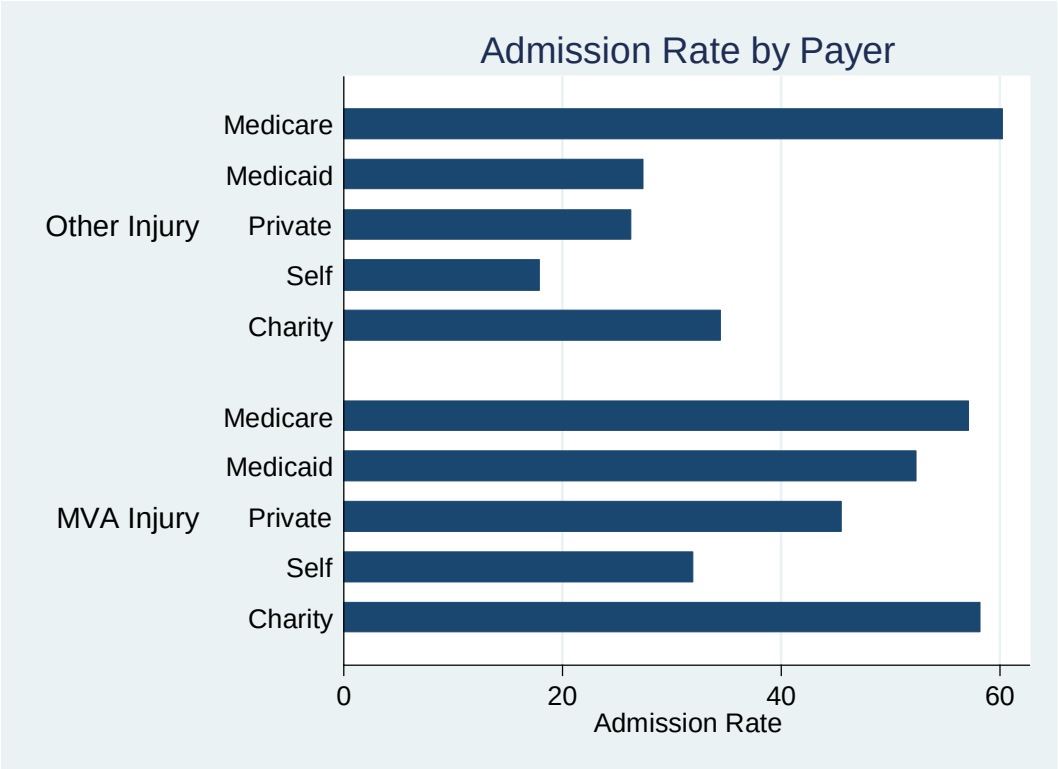

Admission Rate by Payer
Other Injury
Medicare
Medicaid
Private
Self
Charity
MVA Injury
Medicare
Medicaid
Private
Self
Charity
0
20
40
60
Admission Rate

Figure II.3.

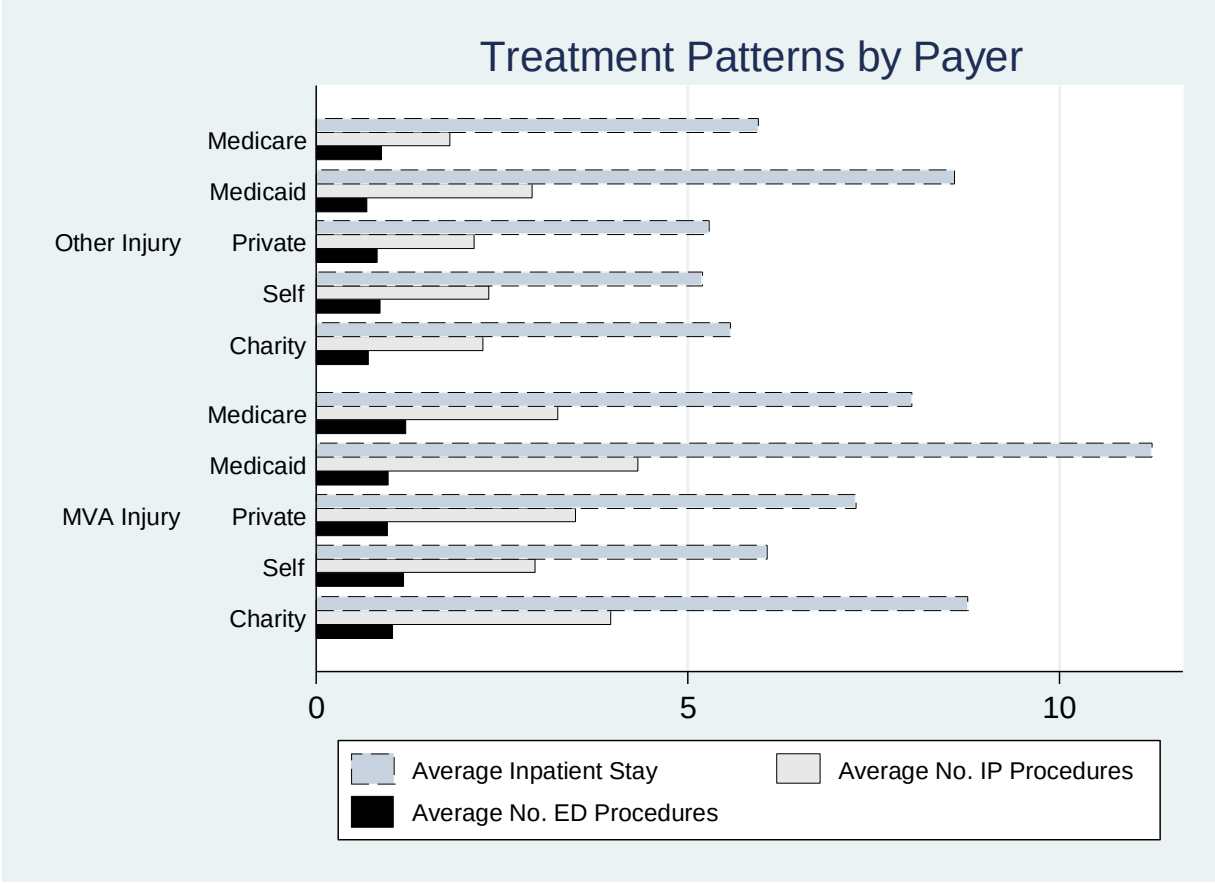

Treatment Patterns by Payer
Other Injury
MVA Injury
Medicare
Medicaid
Private
Self
Charity
Medicare
Medicaid
Private
Self
Charity
0
5
10
Average Inpatient Stay
Average No. IP Procedures
Average No. ED Procedures

Table II.2. Marginal Effects, Mortality		
Variables	MVA Marginal Effects	Other Injury Marginal Effects
Rural Patient	-0.136***	-0.032
	(0.046)	(0.036)
Rural Hospital	0.144**	0.051
	(0.060)	(0.020)
Metro Patient	-0.100***	0.009
	(0.035)	(0.050)
Metro Hospital	-0.144***	-0.001
	(0.042)	(0.035)
Charlson Index	-0.577***	-0.0576***
	(0.0400)	(0.0151)
Income 1	0.078**	-0.007
	(0.034)	(0.024)
Income 2	0.056*	0.023
	(0.033)	(0.025)
Income 3	-0.002	-0.056**
	(0.032)	(0.026)
Weekend Admit	-0.037	-.0.001
	(0.023)	(0.017)
Injury Severity	0.0384***	0.0109***
	(0.001)	(0.001)

Teaching Hosp	-0.105***	0.034
	(0.034)	(0.022)
Medicare	0.061	-0.044
	(0.038)	(0.033)
Medicaid	-0.076	-0.017
	(0.051)	(0.043)
Charity Care	0.264	0.056
	(0.169)	(0.063)
Self-Pay	0.489***	0.143***
	(0.029)	(0.028)
Age	0.015***	0.001
	(0.008)	(0.007)
Female	-0.133***	-0.108***
	(0.023)	(0.018)
South	-0.028	0.029
	(0.035)	(0.020)
Observations	395,341	145,165

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table II.3. Marginal Effects of Insurance Status on the Probability of Admission		
	Motor Vehicle Injury	Other Injury

Medicare	6.85***	8.43***
	(0.656)	(0.708)
Medicaid	5.74***	6.76***
	(0.746)	(0.915)
Charity Care	3.54	15.1***
	(3.25)	(3.17)
Self Pay	-8.84***	-3.42***
	(0.810)	(0.933)
Observations	325,889	145,165

Table II.4. Effects of Insurance Status on Patterns of Treatment						
	MVA Number of ED Procedures	MVA Length of Inpatient Stay	MVA Number of IP Procedures	Other Injury No. of ED Procedures	Other Injury Length of Inpatient Stay	Other Injury No. of IP Procedures
Medicare	0.007	0.048***	0.000	0.001	0.116***	-0.010
	(0.010)	(0.008)	(0.008)	(0.007)	(0.006)	(0.007)
Medicaid	-0.032***	0.231***	0.076***	-0.022***	0.165***	0.028***
	(0.010)	(0.012)	(0.009)	(0.006)	(0.009)	(0.009)
Charity	0.207*	0.050	-0.148***	0.052	-0.004	-0.0506
	(0.110)	(0.031)	(0.035)	(0.037)	(0.032)	(0.035)
Self-paying	-0.005	-0.057***	-0.061***	-0.010	-0.076***	-0.020**
	(0.012)	(0.010)	(0.008)	(0.007)	(0.0094)	(0.010)
Observations	413,053	190,586	135,839	351,706	232,551	141,333

Table II.5. Descriptive Statistics, Sample Under Age 65			
	Motor Vehicle Accident Injury (Standard Deviation)	Other Injury (Standard Deviation)	Differences
Age	36.54 (13.48)	40.45 (13.93)	-3.911***
Weekend Admit	34.1 (47.4)	34.2 (47.4)	-0.05
Female	38.3 (48.6)	42.9 (49.5)	-4.62***
Charlson Index	0.123 (0.385)	0.191 (0.499)	-0.0679***
Injury Severity	11.66 (8.137)	9.497 (5.364)	2.161***
Rural Patient	7.86 (26.9)	7.17 (25.8)	0.682***
Rural Hospital	4.85 (21.5)	6.30 (24.3)	-1.45***
Metro Patient	24.6 (43.1)	26.6 (44.2)	-2.07***
Metro Hospital	86.2 (34.5)	82.2 (38.3)	3.98***
Teaching Hosp.	50.3 (50.0)	33.91 (47.34)	11.1***

Medicare	3.97 (19.5)	11.2 (31.6)	-7.27***
Medicaid	10.2 (30.3)	18.1 (38.5)	-7.87***
Private Ins.	61.3 (48.7)	40.8 (49.2)	20.5***
Self-Pay	24.1 (42.8)	28.0 (44.9)	-3.90***
Charity Care	0.791 (8.86)	1.43 (11.9)	-0.635***
South	47.1 (49.9)	42.2 (49.4)	4.83***
Income 1	27.5 (44.7)	30.1 (45.9)	-2.58***
Income 2	27.2 (44.5)	26.3 (44.0)	0.923***
Income 3	23.8 (42.6)	22.3 (41.6)	1.48***
Income 4	18.5 (38.8)	18.4 (38.7)	0.146
Death in ED	0.762 (8.69)	0.253 (5.03)	0.508***
Admission Rate	41.9 (49.3)	23.2 (42.2)	18.7***

Not South	52.9 (49.9)	57.8 (49.4)	-4.83***
# ED Procedures	1.027 (2.159)	0.793 (1.429)	0.234***
IP Stay Length	7.511 (11.65)	6.124 (9.903)	1.143***
# IP Procedures	3.543 (4.026)	2.401 (2.921)	1.387***
Observations			

Table II.6. Marginal Effects of Insurance Status on Mortality, Under Age 65		
	MVA Marginal Effects	Other Injury Marginal Effects
Medicare	0.130**	-0.000
	(0.054)	(0.072)
Medicaid	-0.079*	-0.019
	(0.046)	(0.056)
Charity Care	0.197	0.064
	(0.141)	(0.084)
Self-Pay	0.427***	0.150***
	(0.028)	(0.038)
Observations	346,468	62,770

Table II.7. Admission Marginal Effects, Under 65		
	MVA Injury	Other Injury
Medicare	0.192	2.69***
	(0.738)	(0.764)
Medicaid	4.19***	3.17***
	(0.725)	(0.760)
Charity	14.9***	9.59***
	(2.89)	(2.54)
Self-pay	-10.5***	-4.26***
	(0.758)	(0.707)
Observations	346,306	62,770

Table II.8. Patterns of Treatment, Under Age 65						
VARIABLES	MVA Number of ED Procedures	MVA Length of Inpatient Stay	MVA Number of IP Procedures	Other Injury No. of ED Procedures	Other Injury Length of Inpatient Stay	Other Injury No. of IP Procedures
Medicare	0.034***	0.100***	0.005	0.025***	0.166***	-0.0249***
	(0.011)	(0.013)	(0.011)	(0.007)	(0.009)	(0.009)
Medicaid	-0.031***	0.235***	0.073***	-0.018***	0.180***	0.030***
	(0.010)	(0.012)	(0.009)	(0.006)	(0.009)	(0.009)
Charity Care	0.203*	0.059*	-0.146***	0.052	0.032	-0.034
	(0.110)	(0.030)	(0.035)	(0.037)	(0.032)	(0.037)
Self-Paying	-0.004	-0.047***	-0.057***	-0.003	-0.042***	-0.015
	(0.012)	(0.010)	(0.009)	(0.007)	(0.010)	(0.010)
Observations	383,441	156,994	114,383	281,301	101,070	59,761

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table II.9. Self Paying and Charity Care Patients						
	Self MVA	Charity MVA	MVA Differences	Self Not MVA	Charity Not MVA	Not MVA Differences
Age	35.13 (13.82)	35.02 (12.81)	0.109	36.98 (14.05)	38.54 (14.88)	-1.559***
Weekend Admission	34.2 (47.4)	35.8 (48.0)	-1.64*	34.3 (47.5)	34.0 (47.4)	0.305
Female	31.3 (46.4)	24.3 (42.9)	7.01***	30.6 (46.1)	27.2 (44.5)	3.34**
Charlson comorbidity	0.0884 (0.321)	0.109 (0.360)	-0.0210***	0.0956 (0.341)	0.140 (0.407)	-0.0441***
Injury Severity	10.64 (7.427)	12.71 (8.053)	-2.074***	9.413 (5.515)	10.10 (6.018)	-0.692***
Rural Patient	7.79 (26.8)	3.90 (19.4)	3.89***	6.66 (24.9)	5.07 (22.0)	1.59**
Rural Hospital	5.33 (22.5)	1.68 (12.9)	3.65***	5.88 (23.5)	4.06 (19.7)	1.82***
Metro Patient	25.2 (43.4)	37.0 (48.3)	-11.7***	26.6 (44.2)	33.1 (47.1)	-6.47***
Metro Hospital	85.3 (35.4)	93.5 (24.7)	-8.15***	82.7 (37.8)	89.7 (30.4)	-6.98***
Teaching Hospital	45.7 (49.8)	59.0 (49.2)	-13.2***	39.7 (48.9)	53.6 (49.9)	-13.9***
Not South	46.4	24.3	22.1***	47.3	37.9	9.47***

	(49.9)	(42.9)		(49.9)	(48.5)	
South	53.6 (49.9)	75.7 (42.9)	-22.1***	52.7 (49.9)	62.1 (48.5)	-9.47***
Income 1	32.6 (46.9)	35.4 (47.8)	-2.84***	36.1 (48.0)	38.3 (48.6)	-2.2
Income 2	28.1 (44.9)	27.4 (44.6)	0.668	27.7 (44.7)	24.0 (42.7)	3.69***
Income 3	21.7 (41.2)	23.1 (42.2)	-1.42*	20.3 (40.2)	23.7 (42.5)	-3.32***
Income 4	13.8 (34.5)	9.22 (28.9)	4.60***	12.2 (32.7)	9.60 (29.5)	2.60***
ED Procedures	1.184 (2.349)	1.033 (2.215)	0.151**	0.855 (1.447)	0.701 (1.256)	0.154***
IPLength of Stay	6.066 (9.122)	8.764 (13.83)	-2.698***	5.191 (8.547)	5.571 (7.302)	-0.381
IP Procedures	2.951 (3.323)	3.969 (4.830)	-1.018***	2.330 (2.733)	2.252 (2.756)	0.0778
ED Fatality	1.33 (11.5)	0.965 (9.78)	0.367*	0.564 (7.49)	0.390 (6.24)	0.173
Admission	32.0 (46.6)	58.2 (49.3)	-26.2***	18.0 (38.4)	34.4 (47.5)	-16.5***

Table II.10. Self-Paying v. Charity Patients	
	Self-Paying
Motor Vehicle Accident Injury Estimates	
ED Fatality (Marginal Effects)	0.369 (0.24)
Admit (Marginal Effects)	-21.3*** (2.47)
ED Proc	0.133 (0.162)
LOS IP	-2.313*** (0.55)
IP Proc	-1.005*** (0.315)
Other Injury Estimates	
ED Fatality (Marginal Effects)	0.216 (0.17)
Admit (Marginal Effects)	-11.6*** (2.07)
ED Proc	0.157* (0.082)
LOS IP	-0.21 (0.39)
IP Proc	0.0937 (0.156)

III. Tables and Figures, Chapter III

Table III.1. Descriptive Statistics			
	N	Mean	SD
Age	790,640	66.51	13.77
Female	790,579	0.385	0.487
Income 1	790,640	0.273	0.446
Income 2	790,640	0.270	0.444
Income 3	790,640	0.236	0.425
Congestive Heart Failure	790,640	0.267	0.442
Peripheral Vascular Disease	790,640	0.0642	0.245
Cerebrovascular Disease	790,640	0.0519	0.222
Dementia	790,640	0.00585	0.0763
COPD	790,640	0.188	0.391
Rheumatoid Disease	790,640	0.0178	0.132
Peptic Ulcer Disease	790,640	0.00878	0.0933
Mild Liver Disease	790,640	0.00304	0.0551
Diabetes	790,640	0.269	0.443
Diabetes w/ Complications	790,640	0.0424	0.201
Hemi or Paraplegia	790,640	0.00394	0.0627
Renal Disease	790,640	0.152	0.359
Cancer	790,640	0.0217	0.146
Moderate/Severe Liver Disease	790,640	0.00220	0.0468
Metastatic Cancer	790,640	0.00878	0.0933
AIDS	790,640	0.00143	0.0378

Charlson Index	790,640	1.616	0.486
Rural Hospital	790,640	0.0818	0.274
Medicare	790,640	0.570	0.495
Medicaid	790,640	0.0603	0.238
Private Ins.	790,640	0.281	0.450
Self-Pay	790,640	0.0692	0.254
Charity Care	790,640	0.00645	0.0801
Prob. of Death in the ED	790,640	0.00995	0.0992
Prob. of Admission	790,640	0.826	0.379
No. of ED Procedures	105,289	1.489	2.887
Inpatient Length of Stay	653,116	4.766	5.438
No. of IP Procedures	653,119	4.704	3.817

Table III.2. Descriptive Statistics					
	Private	Medicare	Medicaid	Uninsured	Charity Patient
Age	57.06 (10.30)	74.69 (9.975)	55.05 (10.93)	52.87 (9.321)	53.04 (8.601)
Female	0.270 (0.444)	0.460 (0.498)	0.414 (0.493)	0.266 (0.442)	0.270 (0.444)
Income 1	0.212 (0.409)	0.280 (0.449)	0.382 (0.486)	0.347 (0.476)	0.328 (0.470)
Income 2	0.260 (0.439)	0.272 (0.445)	0.271 (0.444)	0.285 (0.451)	0.299 (0.458)
Income 3	0.257 (0.437)	0.234 (0.423)	0.195 (0.396)	0.213 (0.409)	0.246 (0.431)
Congestive Heart Failure	0.130 (0.337)	0.359 (0.480)	0.249 (0.433)	0.129 (0.335)	0.134 (0.341)
Peripheral Vascular Disease	0.0338 (0.181)	0.0876 (0.283)	0.0466 (0.211)	0.0248 (0.156)	0.0329 (0.178)
Cerebrovascular Disease	0.0236 (0.152)	0.0714 (0.258)	0.0486 (0.215)	0.0207 (0.142)	0.0192 (0.137)
Dementia	0.000994 (0.0315)	0.00954 (0.0972)	0.00176 (0.0419)	0.000347 (0.0186)	0.000196 (0.0140)

COPD	0.118 (0.322)	0.231 (0.422)	0.216 (0.412)	0.120 (0.325)	0.127 (0.333)
Rheumatoid Disease	0.0125 (0.111)	0.0229 (0.150)	0.0142 (0.118)	0.00545 (0.0736)	0.00549 (0.0739)
Peptic Ulcer Disease	0.00571 (0.0754)	0.0108 (0.103)	0.00955 (0.0972)	0.00521 (0.0720)	0.00764 (0.0871)
Mild Liver Disease	0.00204 (0.0451)	0.00326 (0.0570)	0.00678 (0.0820)	0.00221 (0.0470)	0.00255 (0.0504)
Diabetes	0.225 (0.418)	0.293 (0.455)	0.310 (0.463)	0.219 (0.414)	0.244 (0.429)
Diabetes w/ Complications	0.0264 (0.160)	0.0538 (0.226)	0.0516 (0.221)	0.0160 (0.126)	0.0212 (0.144)
Hemi or Paraplegia	0.00195 (0.0441)	0.00517 (0.0717)	0.00497 (0.0703)	0.00166 (0.0407)	0.00137 (0.0370)
Renal Disease	0.0652 (0.247)	0.216 (0.411)	0.122 (0.327)	0.0431 (0.203)	0.0488 (0.215)
Cancer	0.0120 (0.109)	0.0301 (0.171)	0.0128 (0.112)	0.00514 (0.0715)	0.00647 (0.0802)
Moderate/Severe Liver Disease	0.00143 (0.0377)	0.00244 (0.0493)	0.00411 (0.0640)	0.00175 (0.0418)	0.00255 (0.0504)
Metastatic Cancer	0.00544 (0.0736)	0.0116 (0.107)	0.00789 (0.0885)	0.00199 (0.0446)	0.000784 (0.0280)
AIDS	0.000989 (0.0314)	0.00122 (0.0349)	0.00512 (0.0714)	0.00128 (0.0357)	0.00157 (0.0396)

Charlson Index	1.442 (0.497)	1.731 (0.444)	1.642 (0.479)	1.420 (0.494)	1.465 (0.499)
Rural Hospital	0.0720 (0.258)	0.0848 (0.279)	0.0793 (0.270)	0.0978 (0.297)	0.0402 (0.196)
Prob. of Death in the ED	0.00767*** (0.0873)	0.0111*** (0.105)	0.00638*** (0.0796)	0.0144*** (0.119)	0.00431*** (0.0655)
Prob. of Admission	0.791*** (0.407)	0.857*** (0.350)	0.831*** (0.375)	0.724*** (0.447)	0.876*** (0.329)
No. of ED Procedures	1.534*** (2.839)	1.479*** (2.922)	1.477*** (2.928)	1.572*** (2.985)	1.063*** (2.943)
Inpatient Length of Stay	3.832*** (4.405)	5.252*** (5.558)	5.386*** (7.947)	3.946*** (5.071)	4.296*** (4.811)
No. of IP Procedures	5.695*** (3.522)	4.063*** (3.848)	5.147*** (3.892)	5.599*** (3.481)	6.202*** (3.325)

***The averages for probability of death in the emergency department, probability of admission, the number of emergency department procedures, number of inpatient procedures, and the length of inpatient stay were statistically significantly different from the overall sample average and among groups.

Table III.3. Patient Condition Score by Insurance Status					
	Private	Medicare	Medicaid	Uninsured	Charity Patient
Mean	0.785***	0.590***	0.763***	0.798***	0.821***
SE	0.192	0.210	0.192	0.201	0.167
Observations	222,395	450,590	47,656	54,715	5,102

***The averages for probability of death in the emergency department, probability of admission, the number of emergency department procedures, number of inpatient procedures, and the length of inpatient stay were statistically significantly different from the overall sample average and among groups.

Table III.4. Coefficients for Effects of Insurance Status on Treatment Patterns					
	ED Fatality	Admission	No. ED Procedures	No. IP Procedures	IP Length of Stay
Rural Hospital	0.0576	-1.211***	0.636***	-0.184***	-0.161***
	(0.0561)	(0.0542)	(0.0974)	(0.0235)	(0.0129)
Charlson Index	-1.084***	1.482***	-0.715***	-0.00795**	0.384***
	(0.0429)	(0.0380)	(0.0414)	(0.00348)	(0.00438)
Income 1	0.0794	-0.278***	0.198*	-0.0661***	0.0253***
	(0.0633)	(0.0551)	(0.118)	(0.0148)	(0.00906)
Income 2	0.0826	-0.388***	0.524***	-0.0356***	0.0139
	(0.0664)	(0.0572)	(0.116)	(0.0134)	(0.00861)
Income 3	0.0198	-0.140***	0.179***	-0.00536	0.0108
	(0.0509)	(0.0380)	(0.0639)	(0.0108)	(0.00769)
Weekend Admit	0.0645**	-0.00227	-0.0115	-0.0158***	0.0129***
	(0.0306)	(0.00982)	(0.0255)	(0.00272)	(0.00345)
Teaching Hospital	-0.0183	1.465***	-0.412*	0.251***	0.180***
	(0.0762)	(0.151)	(0.216)	(0.0165)	(0.0103)
Medicare	0.0715	0.195***	-0.118**	0.00187	0.0975***
	(0.0509)	(0.0223)	(0.0464)	(0.00493)	(0.00522)
Medicaid	0.0314	0.152***	-0.208***	-0.0470***	0.255***
	(0.0804)	(0.0274)	(0.0546)	(0.00869)	(0.0104)
Charity	-0.430*	0.682***	-1.459***	0.0570***	0.0983***
	(0.221)	(0.105)	(0.192)	(0.0185)	(0.0216)

Self-pay	0.570***	-0.159***	-0.0165	-0.0510***	0.0455***
	(0.0585)	(0.0297)	(0.0498)	(0.00652)	(0.00833)
Age	0.0140***	0.0337***	-0.0192***	-0.00507***	0.00462***
	(0.00176)	(0.000945)	(0.00157)	(0.000220)	(0.000203)
Female	-0.192***	0.197***	-0.0642***	-0.0831***	-0.00912***
	(0.0296)	(0.0108)	(0.0215)	(0.00299)	(0.00325)
Midwest Region	-0.323***	-0.0247	0.642***	0.253***	-0.0515***
	(0.0730)	(0.0776)	(0.113)	(0.0266)	(0.0146)
Southern Region	0.0522	0.00794	2.177***	0.185***	0.0196
	(0.0801)	(0.0987)	(0.170)	(0.0278)	(0.0143)
West	-0.187***	0.377***	-0.858***	0.242***	-0.0482***
	(0.0704)	(0.0930)	(0.157)	(0.0326)	(0.0177)
Patient Condition Index	-3.437***	4.021***	-0.975***	1.449***	-0.298***
	(0.0781)	(0.0965)	(0.123)	(0.0189)	(0.0143)
Constant	-1.786***	-5.846***	-0.246	0.564***	0.652***
	(0.158)	(0.202)	(0.235)	(0.0362)	(0.0254)
Observations	790,424	781,095	790,424	653,082	653,079

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table III.5. Marginal Effects of Insurance Status on Treatment Patterns

	ED Fatality	Admission	No. ED Procedures	No. IP Procedures	IP Length of Stay

Medicare	0.0433	1.789***	-0.0108***	0.00829	0.448***
	(0.0308)	(0.210)	(0.00417)	(0.0218)	(0.0241)
Medicaid	0.0190	1.399***	-0.0189***	-0.208***	1.173***
	(0.0488)	(0.260)	(0.00501)	(0.0385)	(0.0483)
Charity Care	-0.261*	6.268***	-0.133***	0.253***	0.452***
	(0.135)	(1.112)	(0.0230)	(0.0818)	(0.0993)
Self-Pay	0.345***	-1.466***	-0.00150	-0.226***	0.209***
	(0.0371)	(0.253)	(0.00456)	(0.0290)	(0.0383)
Observations	790,424	781,095	790,424	653,082	653,079
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1					

Figure III.1. Time Series of Patient Condition Index by Insurance Status.

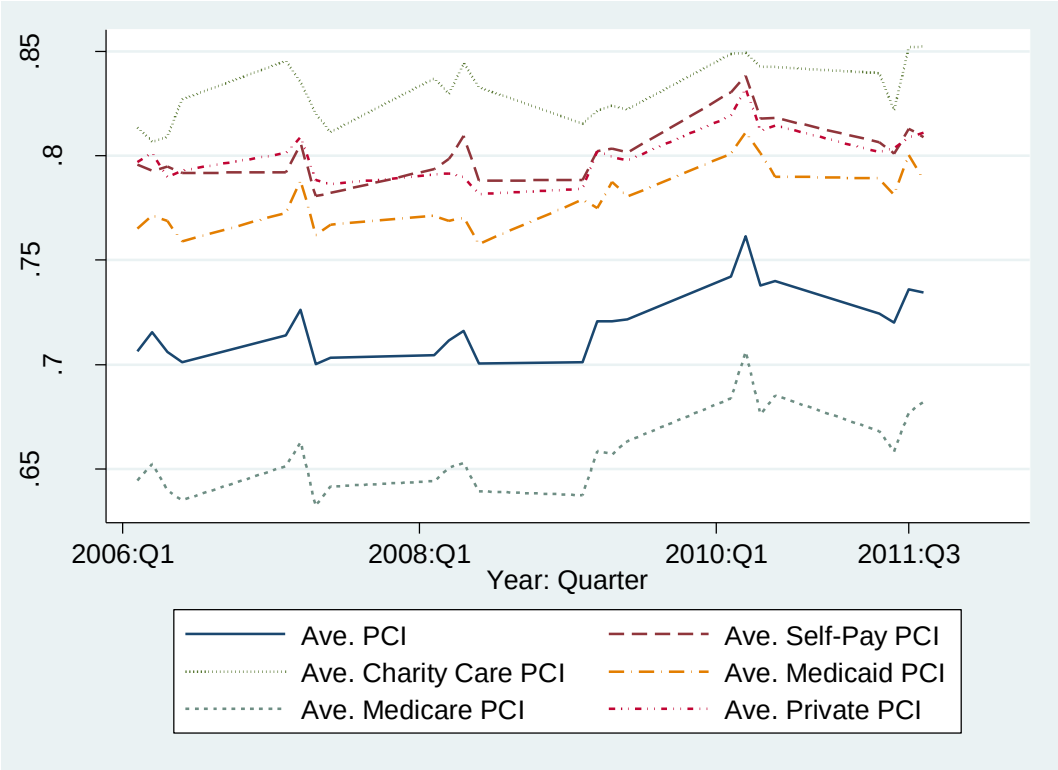


Table III.6. Differences in Marginal Effects of Outcome and Treatment by Insurance Status and the Great Recession.

Fatality in the Emergency Department						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	0.0464	0.0265	0.0729	-0.0481	0.0248	-0.0216
	(0.0468)		(0.0457)		(0.0503)	
Medicaid	0.0646	0.0279	0.0925	-0.1371	-0.0446	-0.1092
	(0.0716)		(0.0721)		(0.0822)	
Charity Care	0.108	-0.299	-0.191	-0.774	-0.965**	-1.073**
	(0.173)		(0.219)		(0.402)	
Self-Pay	0.362***	-0.05	0.312***	0.026	0.338***	-0.024
	(0.0540)		(0.0537)		(0.0611)	
Admission Probability						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	1.196***	0.195	1.391***	0.954	2.345***	1.149
	(0.198)		(0.212)		(0.373)	
Medicaid	0.295	1.198***	1.493***	0.598	2.091***	1.796**
	(0.315)		(0.310)		(0.458)	
Charity Care	1.350	1.435	2.785***	8.675**	11.46***	10.11***
	(0.977)		(1.066)		(2.213)	
Self-Pay	-1.398***	0.002	-1.396***	0.145	-1.251***	0.147
	(0.353)		(0.276)		(0.448)	

Number of Emergency Department Procedures						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	-0.00686** (0.00340)	0.006444	-0.000416 (0.00361)	-0.014984*	-0.0154*** (0.00590)	-0.00854
Medicaid	-0.0134* (0.00685)	0.00916	-0.00424 (0.00583)	-0.01926	-0.0235*** (0.00731)	-0.0101
Charity Care	-0.0389*** (0.0120)	-0.0134	-0.0523*** (0.0142)	-0.1467***	-0.199*** (0.0416)	-0.1601***
Self-Pay	0.00355 (0.00469)	0.00536	0.00891** (0.00417)	-0.01359**	-0.00468 (0.00713)	-0.00823
Number of Inpatient Procedures						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	-0.0257 (0.0332)	0.1101**	0.0844** (0.0396)	-0.1101**	-0.0257 (0.0329)	0.000
Medicare	-0.297*** (0.0699)	0.088	-0.209*** (0.0633)	-0.003	-0.212*** (0.0547)	0.085
Charity Care	0.313** (0.151)	0.211	0.524*** (0.138)	-0.42***	0.104 (0.116)	-0.209
Self-Pay	-0.235***	-0.015	-0.250***	0.022	-0.228***	0.007

	(0.0493)		(0.0496)		(0.0429)	
Inpatient Length of Stay						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	0.477*** (0.0427)	0.069	0.546*** (0.0461)	-0.138**	0.408*** (0.0355)	-0.069
Medicare	1.362*** (0.0853)	-0.157	1.205*** (0.0830)	-0.103	1.102*** (0.0706)	-0.26
Charity Care	0.650*** (0.147)	0.247	0.897*** (0.207)	-0.765***	0.132 (0.125)	-0.518*
Self-Pay	0.254*** (0.0741)	-0.065	0.189*** (0.0716)	0.031	0.220*** (0.0541)	-0.034

Table III.7. Alternative Patient Condition Score by Time Period			
	Pre-Recession	Recession	Post-Recession
Mean	0.0151***	0.0115***	0.0163***
SE	0.039	0.0263	0.0472
Observations	145,492	167,888	374,260

***The averages for probability of death in the emergency department, probability of admission, the number of emergency department procedures, number of inpatient procedures, and the length of inpatient stay were statistically significantly different from the overall sample average and among groups.

Table III.8. Differences in Marginal Effects for Outcome and Treatment by Insurance Status and the Great Recession. Alternate Condition Index.

Fatality in the Emergency Department						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	0.0893 (0.0632)	*0.0117*	0.101* (0.0545)	*-0.0134*	0.0876 (0.0591)	*-0.0017*
Medicaid	0.104 (0.0946)	*-0.0302*	0.0738 (0.0841)	*-0.0971*	-0.0233 (0.0921)	*-0.1273*
Charity Care	0.0658 (0.222)	*-0.3788*	-0.313 (0.262)	*-0.79*	-1.103** (0.452)	*-1.1688***
Self-Pay	0.454*** (0.0669)	*-0.101*	0.353*** (0.0607)	*0.059*	0.412*** (0.0681)	*-0.042*
Admission Probability						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	0.738*** (0.258)	*0.104*	0.842*** (0.249)	*0.704*	1.546*** (0.384)	*0.808*
Medicaid	-0.0668 (0.401)	*1.5038****	1.437*** (0.350)	*0.179*	1.616*** (0.452)	*1.6828***
Charity Care	2.109* (1.251)	*1.783*	3.892*** (1.234)	*7.398***	11.29*** (2.190)	*9.181****
Self-Pay	-1.799*** (0.419)	*0.487*	-1.312*** (0.306)	*0.259*	-1.053** (0.437)	*0.746**

Number of Emergency Department Procedures						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	-0.00639 (0.00428)	*0.00904*	0.00265 (0.00393)	*-0.0185***	-0.0158*** (0.00588)	*-0.0094*
Medicaid	-0.0162** (0.00736)	*0.00724*	-0.00896 (0.00555)	*-0.0154*	-0.0244*** (0.00729)	*-0.0082*
Charity Care	-0.0480*** (0.0137)	*-0.0027*	-0.0507*** (0.0156)	*-0.1413****	-0.192*** (0.0417)	*-0.144****
Self-Pay	0.00233 (0.00512)	*0.00583*	0.00816* (0.00452)	*-0.0142**	-0.00604 (0.00714)	*-0.0084*
Number of Inpatient Procedures						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	-0.189*** (0.0403)	*0.1751****	-0.0139 (0.0441)	*-0.1801****	-0.194*** (0.0342)	*-0.005**
Medicaid	-0.446*** (0.0790)	*0.122*	-0.324*** (0.0684)	*-0.001*	-0.325*** (0.0578)	*0.121*
Charity Care	0.406** (0.168)	*0.178*	0.584*** (0.161)	*-0.5079****	0.0761 (0.127)	*-0.3299*
Self-Pay	-0.230***	*-0.052*	-0.282***	*0.053*	-0.229***	*0.001*

	(0.0526)		(0.0538)		(0.0448)	
Inpatient Length of Stay						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare Medicaid	0.315*** (0.0423)	*0.217****	0.532*** (0.0491)	*-0.096*	0.436*** (0.0362)	*0.121***
Charity Care	1.087*** (0.0814)	*0.003*	1.090*** (0.0891)	*-0.007*	1.083*** (0.0701)	*-0.004*
Self-Pay	0.633*** (0.145)	*0.244*	0.877*** (0.212)	*-0.706****	0.171 (0.128)	*-0.462***
Medicare	0.260*** (0.0667)	*-0.06*	0.200*** (0.0724)	*0.011*	0.211*** (0.0539)	*-0.049*

Table III.9. Differences in Marginal Effects for Outcome and Treatment by Insurance Status and the Great Recession.

Under 65.

Fatality in the Emergency Department						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	0.239*** (0.0575)	-0.053	0.186*** (0.0557)	0.003	0.189*** (0.0561)	-0.05
Medicaid	0.0808 (0.0705)	0.0057	0.0865 (0.0728)	-0.0607	0.0258 (0.0705)	-0.055
Charity Care	0.138 (0.163)	-0.273	-0.135 (0.200)	-1.229**	-1.364*** (0.500)	-1.502**
Self-Pay	0.329*** (0.0538)	-0.08	0.249*** (0.0530)	0.029	0.278*** (0.0533)	-0.051
Admission Probability						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	2.360*** (0.417)	-0.243	2.117*** (0.414)	0.664	2.781*** (0.444)	0.421
Medicaid	0.237 (0.476)	1.937***	2.174*** (0.466)	-0.252	1.922*** (0.546)	1.685*
Charity Care	2.253 (1.443)	1.611	3.864** (1.545)	9.416***	13.28*** (2.693)	11.027***
Self-Pay	-1.917***	-0.134	-2.051***	-0.231	-2.282***	-0.365

	(0.439)		(0.386)		(0.506)	
Number of Emergency Department Procedures						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	-0.0107* (0.00639)	0.00811	-0.00259 (0.00753)	-0.0033	-0.00588 (0.00837)	0.00482
Medicaid	-0.0196** (0.00956)	0.0133	-0.00630 (0.00829)	-0.0113	-0.0176* (0.00947)	0.002
Charity Care	-0.0564*** (0.0175)	-0.0125	-0.0689*** (0.0200)	-0.1781***	-0.247*** (0.0539)	-0.1906***
Self-Pay	0.00323 (0.00633)	0.01007	0.0133** (0.00609)	-0.0061	0.00716 (0.00949)	0.00393
Number of Inpatient Procedures						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	-0.634*** (0.0567)	-0.023	-0.657*** (0.0566)	0.03	-0.627*** (0.0496)	0.007
Medicaid	-0.525*** (0.0804)	0.107	-0.418*** (0.0723)	0.143*	-0.275*** (0.0612)	0.25***
Charity Care	0.531*** (0.174)	0.221	0.752*** (0.162)	-0.517***	0.235* (0.131)	-0.296
Self-Pay	-0.212*** (0.0560)	-0.03	-0.242*** (0.0561)	0.074	-0.168*** (0.0476)	0.044

Inpatient Length of Stay						
	Pre-recession 2006Q1-2007Q3	*Recession-Pre-Recession Differences*	Recession 2007Q4-2009Q2	*Post-Recession-Recession Differences*	Post-Recession 2009Q3-2011Q4	*Post-Recession-Pre-Recession Differences*
Medicare	0.434*** (0.0534)	0.142*	0.576*** (0.0617)	-0.16*	0.416*** (0.0408)	-0.018
Medicaid	1.102*** (0.0794)	-0.111	0.991*** (0.0789)	-0.043	0.948*** (0.0634)	-0.154
Charity Care	0.655*** (0.131)	0.07	0.725*** (0.154)	-0.595***	0.130 (0.110)	-0.525***
Self-Pay	0.236*** (0.0640)	-0.056	0.180*** (0.0615)	0.038	0.218*** (0.0463)	-0.018

Figure III.3. Time Series of Admissions across Insurance Status.

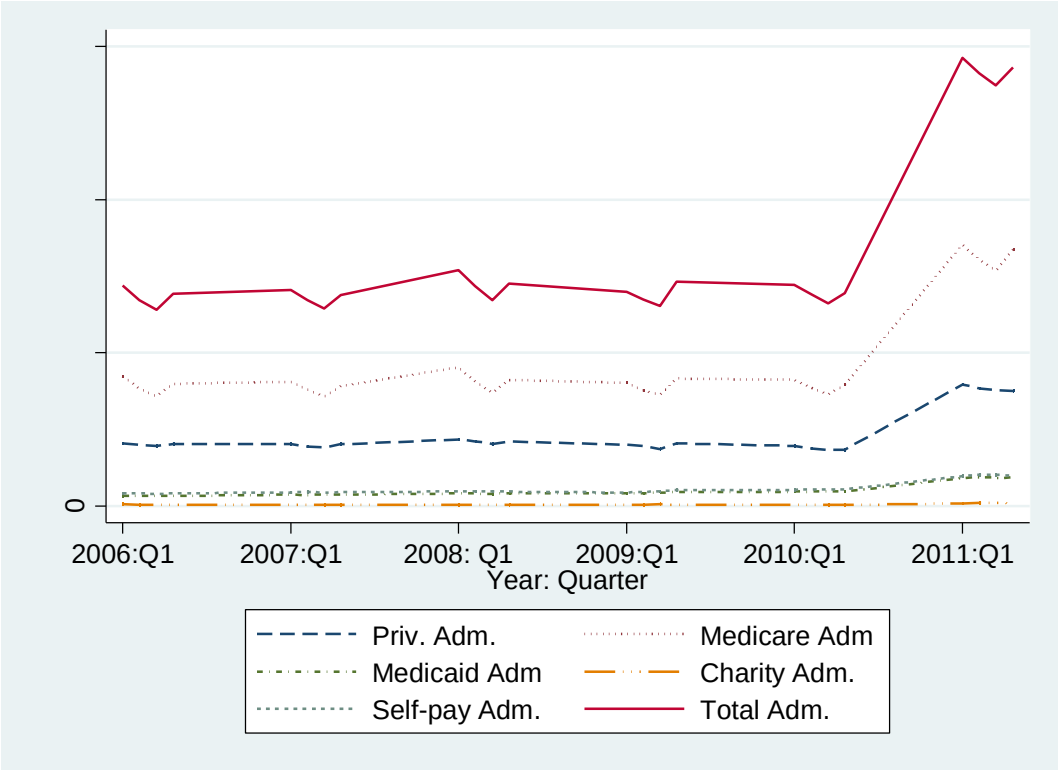
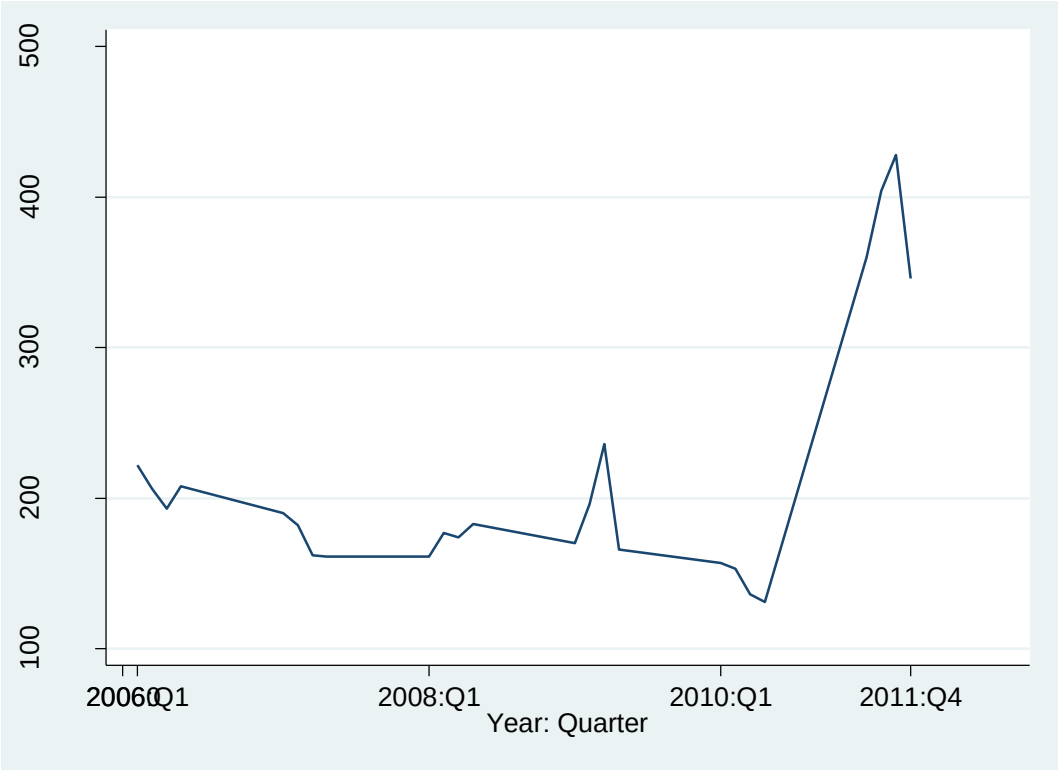


Figure III.4. Time Series of Charity Care Admissions



APPENDICES.

Appendix I.

Table I.A1. Literature Summary

Paper	Data Set	Dependent Variable	Independent Variable	Conclusions
Gronfein and Kinney, 1991	Ohio, Indiana, and Michigan malpractice claims	Size of plaintiff's claim	Damage caps	Average claims in Indiana were larger than those in either Ohio or Michigan, which did not pass any tort reform during the period of interest.
Kessler and McClellan, 1996	Medicare claims 1984, 1987, 1990	Medical expenditures	Damage caps	Direct liability reforms, specifically damage caps, cause meaningful decreases in expenditure growth, while having no important impact on mortality and other common complications.
Kessler and McClellan, 1998	AMA SMS	Perceived malpractice pressure as reported by physicians.	Joint and several liability reform	Liability reforms directly affect malpractice pressure cause lower growth in malpractice claim rates and real medical malpractice premiums.

Yoon, 2001	St. Paul Fire and Marine Insurance Co. records	Average plaintiff recovery in malpractice cases	Damage caps	Average plaintiff recovery decreased by $20,000.
Viscusi and Born, 2005	Property and casualty insurance files, National Association of Insurance Commissioners, 1984-1991	Malpractice insurance losses, malpractice premiums, malpractice insurance loss ratios	Damage caps and joint and several liability reform	Liability reforms reduce losses, lower premiums and enhance insurance profitability
Matsa, 2007	County level, specialty specific counts of physicians, 1970-2000	Ratio of Physicians to Population	Damage caps	The average effect of the physician to population ratio is zero; however, for rural areas, specialist supply increases 10-12%
Currie and MacLeod, 2008	Birth Records 1989-2001	Pregnancy complications	Joint and several liability reform	JSL has a slightly negative effect on the complication rate.
Durrance, 2009	Malpractice claims, National Practitioner Database, 1991-2001	Log of positive malpractice payouts by state	Damage caps	No reduction in the frequency of malpractice payouts as a result of tort reforms.
Avraham, Dafny and Schanzenbach, 2009	LEHID	Health insurance premiums	Joint and several liability reform	JSL reform reduces premiums by 1-2%.
Sloan and Shadle, 2009	National Long Term Care	Medicare claim payments	Joint and several	Liability reform reduced Medicare

	Survey, 1985-2000		liability reform	hospitalization payments
Avraham and Bustos, 2010	Theory	Time to settlement, litigation expenses, plaintiff recovery, proportion of settled disputes	Damage caps	Settlements are delayed when damage caps are present, but uncertainty over their future legality is in question.
Avraham and Schanzenbach, 2010	CPS	Probability of private insurance	Damage caps and joint and several liability	Tort reform, including JSL, increases health coverage and decreases aggregate health costs.

Table I.A2. States with Joint and Several Reforms.

Type of Reform	Number of States
Joint and Several Liability Reform	37
Ban	9
50% Liability	11
Defendant Greater Liability	7
Blameless Plaintiff	4
Intentional Actions	8
Acts in Concert	8

Table I.A3. Placebo Regressions, Aggregate Per Capita Spending Growth.

	Estimated Coefficient	Initial Standard Error	Placebo Standard Error	Initial T-statistic	Placebo T-statistic
JSL	-0.477	0.187	0.132	**-2.551****	**-3.614*****
Ban	-0.396	0.330	0.167	-1.200	**-2.371****
Intent	-0.097	0.233	0.177	-0.416	-0.548
Concert	-0.671	0.651	0.177	-1.031	**-3.791*****
Fifty	-0.394	0.404	0.162	-0.978	**-2.432****
Blameless	-0.421	0.147	0.234	**-2.864*****	**-1.799***
Greater	-1.188	0.154	0.315	**-7.714*****	**-3.771*****
Any	-1.043	0.282	0.134	**-3.699*****	**-7.784*****

a. Dependent variable is percentage growth rate in aggregated per capita healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for state-level changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Table I.A4. Placebo Regressions, Aggregate Spending Per Enrollee Medicare Growth.

	Estimated Coefficient	Initial Standard Error	Placebo Standard Error	Initial T-statistic	Placebo T-statistic
JSL	-0.570	0.257	0.172	**-2.218****	**-3.314*****
Ban	-2.227	1.228	0.214	**-1.814***	**-10.407*****
Intent	0.125	0.798	0.226	0.157	0.553
Concert	-0.290	1.163	0.231	-0.249	-1.255
Fifty	-0.259	0.432	0.206	-0.600	-1.257
Blameless	-1.331	0.181	0.304	**-7.354*****	**-4.378*****
Greater	-0.832	0.164	0.426	**-5.073*****	**-1.953***
Any	-0.861	0.433	0.175	**-1.988****	**-4.920*****

a. Dependent variable is percentage growth rate in aggregated per enrollee Medicare healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for state-level changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Table I.A5. Placebo Regressions, Aggregate per Enrollee Medicaid Spending Growth.

	Estimated Coefficient	Initial Standard Error	Placebo Standard Error	Initial T-statistic	Placebo T-statistic
JSL	1.496	1.739	0.771	0.860	**1.940***
Ban	1.276	1.791	0.978	0.712	1.305
Intent	-2.638	1.173	1.033	**-2.249****	**-2.554****
Concert	-0.870	1.217	1.052	-0.715	-0.827
Fifty	0.179	1.527	0.958	0.117	0.187
Blameless	-1.851	0.666	1.328	**-2.780*****	-1.394
Greater	-0.166	0.665	1.852	-0.250	-0.090
Any	-0.524	2.384	0.802	-0.220	-0.653

a. Dependent variable is percentage growth rate in aggregated per enrollee Medicaid healthcare expenditures. Standard errors, in parentheses, are corrected by clustering at the state level.

b. * .1 significance, **.05 significance, ***.01 significance.

c. Controls for state-level changes in the bad health index, uninsurance rate, community hospital beds per capita, proportion of the state that is African-American, female and over 65 and changes in real income.

Appendix III.

Appendix Table III.1. Differences in Outcome and Treatment by Insurance Status and the Great Recession. Regression Coefficients.

Death in the Emergency Department						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.0877 (0.0885)	0.0473	0.135 (0.0846)	-0.0963	0.0387 (0.0784)	-0.049
Medicaid	0.122 (0.135)	0.05	0.172 (0.134)	-0.2414	-0.0694 (0.129)	-0.1914
Charity Care	0.205 (0.328)	-0.559	-0.354 (0.405)	-1.149	-1.503 (0.62)	-1.708**
Self-Pay	0.683 (0.1)	-0.105	0.578 (0.1)	-0.052	0.526 (0.0916)	-0.157
Admission Probability						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.179 (0.0293)	0.018	0.197 (0.0297)	0.016	0.213 (0.0333)	0.034
Medicaid	0.0441 (0.0471)	0.1669***	0.211 (0.0426)	-0.021	0.19 (0.0393)	0.1459**
Charity Care	0.202 (0.147)	0.192	0.394 (0.15)	0.649***	1.043 (0.17)	0.841***
Self-Pay	-0.209 (0.0522)	0.012	-0.197 (0.0387)	0.083	-0.114 (0.0435)	0.095
Number of Emergency Department Procedures						

	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	-0.117 (0.0585)	0.11007	-0.00693 (0.0603)	-0.14707*	-0.154 (0.0585)	-0.037
Medicaid	-0.228 (0.113)	0.1573	-0.0707 (0.0971)	-0.1643	-0.235 (0.0714)	-0.007
Charity Care	-0.665 (0.193)	-0.206	-0.871 (0.234)	-1.117***	-1.988 (0.332)	-1.323***
Self-Pay	0.0606 (0.0808)	0.0874	0.148 (0.0702)	-0.1948**	-0.0468 (0.0706)	-0.1074
Number of Inpatient Procedures						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	-0.00635 (0.00819)	0.02605**	0.0197 (0.00923)	-0.02518**	-0.00548 (0.00702)	0.00087
Medicaid	-0.0734 (0.0172)	0.0246	-0.0488 (0.0147)	0.0035	-0.0453 (0.0117)	0.0281
Charity Care	0.0771 (0.0371)	0.0449	0.122 (0.0322)	-0.0999***	0.0221 (0.0247)	-0.055
Self-Pay	-0.0579 (0.012)	-0.0004	-0.0583 (0.0116)	0.0096	-0.0487 (0.0091)	0.0092
Inpatient Length of Stay						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.0998	0.0152	0.115	-0.0231*	0.0919	-0.0079

	(0.00884)		(0.00967)		(0.008)	
Medicaid	0.285 (0.0178)	-0.03	0.255 (0.0174)	-0.006	0.249 (0.0158)	-0.036
Charity Care	0.136 (0.0309)	0.054	0.19 (0.0436)	-0.1602***	0.0298 (0.0282)	-0.1062**
Self-Pay	0.0531 (0.0155)	-0.0132	0.0399 (0.0151)	0.0098	0.0497 (0.0122)	-0.0034

Appendix Table III.2. Differences in Outcome and Treatment by Insurance Status and the Great Recession. Alternate Patient Condition Index. Regression Coefficients.						
Fatality in the Emergency Department						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.132 (0.0930)	0.03	0.162* (0.0874)	-0.042	0.120 (0.0812)	-0.012
Medicaid	0.154 (0.139)	-0.036	0.118 (0.135)	-0.15	-0.0320 (0.127)	-0.186
Charity Care	0.0970 (0.327)	-0.6	-0.503 (0.419)	-1.011	-1.514** (0.616)	-1.611**
Self-Pay	0.669*** (0.0975)	-0.103	0.566*** (0.0977)	0	0.566*** (0.0909)	-0.103
Admission Probability						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.0857*** (0.0301)	0.0173	0.103*** (0.0306)	0.037	0.140*** (0.0345)	0.0543
Medicaid	-0.00776 (0.0466)	0.18376***	0.176*** (0.0419)	-0.03	0.146*** (0.0392)	0.15376 **
Charity Care	0.245* (0.146)	0.232	0.477*** (0.151)	0.543**	1.020*** (0.167)	0.775 ***
Self-Pay	-0.209*** (0.0481)	0.048	-0.161*** (0.0376)	0.0658	-0.0952** (0.0419)	0.1138*
Number of Emergency Department Procedures						

	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	-0.0925 (0.0621)	0.135	0.0425 (0.0629)	-0.2055**	-0.163*** (0.0599)	-0.0705
Medicaid	-0.234** (0.103)	0.09	-0.144 (0.0883)	-0.108	-0.252*** (0.0726)	-0.018
Charity Care	-0.695*** (0.187)	-0.118	-0.813*** (0.248)	-1.175***	-1.988*** (0.348)	-1.293***
Self-Pay	0.0337 (0.0744)	0.0973	0.131* (0.0731)	-0.1934*	-0.0624 (0.0727)	-0.0961
Number of Inpatient Procedures						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	-0.0434*** (0.00926)	0.04033***	-0.00307 (0.00976)	-0.0374***	-0.0405*** (0.00717)	0.0029
Medicaid	-0.102*** (0.0181)	0.0303	-0.0717*** (0.0151)	0.0038	-0.0679*** (0.0121)	0.0341
Charity Care	0.0934** (0.0386)	0.0356	0.129*** (0.0356)	-0.1131***	0.0159 (0.0265)	-0.0775*
Self-Pay	-0.0530*** (0.0119)	-0.0093	-0.0623*** (0.0119)	0.0145	-0.0478*** (0.00933)	0.0052
Inpatient Length of Stay						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.0740***	0.044***	0.118***	-0.0184	0.0996***	0.0256**

	(0.00990)		(0.0108)		(0.00825)	
Medicaid	0.256*** (0.0191)	-0.015	0.241*** (0.0195)	0.006	0.247*** (0.0159)	-0.009
Charity Care	0.149*** (0.0342)	0.045	0.194*** (0.0467)	-0.155***	0.0390 (0.0293)	-0.11**
Self-Pay	0.0611*** (0.0157)	-0.0168	0.0443*** (0.0160)	0.0039	0.0482*** (0.0123)	-0.0129

Appendix Table III.3. Differences in Outcome and Treatment by Insurance Status and the Great Recession. Under 65. Regression Coefficients.

Death in Emergency Department						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.495*** (0.118)	-0.113	0.382*** (0.116)	-0.007	0.375*** (0.111)	-0.12
Medicaid	0.167 (0.145)	0.01	0.177 (0.150)	-0.1258	0.0512 (0.140)	-0.1158
Charity Care	0.284 (0.337)	-0.562	-0.278 (0.408)	-2.434**	-2.712*** (1.012)	-2.996***
Self-Pay	0.680*** (0.107)	-0.169	0.511*** (0.109)	0.042	0.553*** (0.103)	-0.127
Probability of Admission						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.244*** (0.0424)	-0.031	0.213*** (0.0405)	-0.002	0.211*** (0.0334)	-0.033
Medicaid	0.0244 (0.0492)	0.1946***	0.219*** (0.0457)	-0.073	0.146*** (0.0405)	0.1216*
Charity Care	0.233 (0.149)	0.156	0.389** (0.155)	0.617***	1.006*** (0.178)	0.773***
Self-Pay	-0.198*** (0.0447)	-0.008	-0.206*** (0.0384)	0.033	-0.173*** (0.0419)	0.025
Number of Emergency Department Procedures						

	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	-0.126* (0.0757)	0.0955	-0.0305 (0.0886)	-0.0147	-0.0452 (0.0641)	0.0808
Medicaid	-0.232** (0.107)	0.1578	-0.0742 (0.0975)	-0.0608	-0.135* (0.0722)	0.097
Charity Care	-0.667*** (0.192)	-0.145	-0.812*** (0.232)	-1.083***	-1.895*** (0.335)	-1.228***
Self-Pay	0.0382 (0.0755)	0.1188	0.157** (0.0723)	-0.102	0.0550 (0.0735)	0.0168
Number of Inpatient Procedures						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	-0.123*** (0.0108)	0.002	-0.121*** (0.0103)	0.011	-0.110*** (0.00873)	0.013
Medicaid	-0.102*** (0.0156)	0.0247	-0.0773*** (0.0133)	0.0291*	-0.0482*** (0.0107)	0.0538***
Charity Care	0.103*** (0.0339)	0.036	0.139*** (0.0301)	-0.0979***	0.0411* (0.0230)	-0.0619
Self-Pay	-0.0412*** (0.0108)	-0.0036	-0.0448*** (0.0104)	0.0154	-0.0294*** (0.00834)	0.0118
Length of Inpatient Stay						
	Pre-recession	*Recession- Pre-Recession Differences*	Recession	*Post-Recession-Recession Differences*	Post-Recession	*Post-Recession - Pre-Recession Differences*
Medicare	0.109***	0.035*	0.144***	-0.036*	0.108***	-0.001

	(0.0135)		(0.0154)		(0.0107)	
Medicaid	0.277*** (0.0198)	-0.03	0.247*** (0.0194)	0	0.247*** (0.0164)	-0.03
Charity Care	0.164*** (0.0331)	0.017	0.181*** (0.0385)	-0.1471***	0.0339 (0.0286)	-0.1301***
Self-Pay	0.0592*** (0.0160)	-0.0143	0.0449*** (0.0153)	0.0119	0.0568*** (0.0121)	-0.0024

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