The Influence of Malpractice Insurance Premiums on Physician Location Decisions

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Abstract

Existing economic literature has suggested that areas that implement caps limiting noneconomic damages in malpractice lawsuits experience a greater increase in physician supply than areas that do not have noneconomic damage caps. It has been proposed that noneconomic damage caps achieve this effect by reducing malpractice premiums. Specifically, noneconomic damage caps are presumed to reduce malpractice premiums either by reducing the number of malpractice claims filed, or by reducing the size of payouts for malpractice claims. I find that physicians do respond to malpractice rates when choosing where to practice, but that noneconomic damage caps do not appear to significantly reduce malpractice premiums and thus have minimal indirect impact on physician supply in an area.

Introduction:

This study investigates whether the cost of malpractice insurance premiums affects where physicians decide to practice and if malpractice noneconomic damage caps induce growth in physician supply via reduced insurance premiums.

Healthcare patients in the United States who are injured through negligent practice can seek restitution through medical malpractice suits. Generally, these suits fall under a body of civil law called torts, which cover wrongs that do not involve any contractual relationship. The legislation covering malpractice torts varies among states, but in general these laws are designed to provide victim compensation and deter medical malpractice. Most states require that healthcare providers purchase professional liability insurance to protect themselves from malpractice claims (Mello, 2006). Because malpractice premiums may be an important factor affecting physician income, the price of professional liability insurance may have a strong effect on the location where physicians choose to practice. Consequently, tort laws that influence the price of malpractice insurance may have an indirect influence on physician supply in geographic areas for which they apply. I attempt to quantify this impact by analyzing changes in physician supply and malpractice insurance premiums in states that have enacted tort reforms as compared to states that did not have tort reforms in place from 1996 to 2006.

In an economic sense, the extent to which tort reform will increase the supply of physicians will depend on three factors: 1) physicians' sensitivity to changes in

income; 2) the extent to which malpractice premiums affect physicians' income; and 3) the degree to which tort laws affect malpractice premiums. Physicians have sought to reduce their malpractice premiums in a number of ways. While individual practitioners typically purchase malpractice insurance out-of-pocket, hospitals often purchase policies that cover their medical staff (Mello, 2006). Because larger institutions have more leverage in negotiating insurance rates than individual practitioners, physicians may seek to align more closely with hospitals in an effort to seek affordable insurance (Mello, 2006). Physicians' income is only indirectly affected by changes in insurance premiums when hospitals buy their malpractice insurance, which may reduce their sensitivity to rate changes. Moreover, an increasing number of hospitals have opted to self-insure in an effort to avoid insurance rate increases. Similarly, there has been significant growth in physician owned and operated insurance companies (Hillman & Cluff, 2003). These non-profit, physician owned companies may be able to offer better rates because of a superior knowledge of the practicing physicians in the market (Hillman & Cluff, 2003). Furthermore, because the physicians themselves own the companies, they may have more motivation to try and prevent malpractice claims. If these measures successfully reduce the prices doctors pay for malpractice insurance, they may diminish the effects of tort reform on physician supply. Beyond economic factors, it is important to consider that tort reforms may offer psychological incentives for physicians to practice in certain geographic areas as well, such as peace of mind about awards beyond what their insurance policy covers, and reduced stress over having to go through a litigation procedure.

Malpractice insurance premiums and their growth rates vary widely both geographically and by medical specialty. Differing legal environments are likely one source of this variation. Awards from malpractice suits usually consist of several elements, including punitive damages, economic damages (lost wages, medical bills, and legal fees), and noneconomic damages (physical pain, emotional distress, loss of enjoyment of life, physical impairment). Awards associated with these elements are subject to individual regulations that vary by state. Consequently, state specific tort laws may affect the size and frequency of malpractice claims.

Malpractice claims are a major cost faced by insurers providing professional liability insurance for physicians. Thus, it is expected that the monetary value and frequency of these claims are likely important determinants of the price of malpractice insurance, and that tort reforms that make it more difficult to file malpractice claims or that limit the size of malpractice awards may reduce premiums. Additionally, tort reforms that limit damage awards may further reduce premiums by enabling insurers to better predict potential payouts (Hillman & Cluff, 2003). If insurers demand compensation for greater payout uncertainty, the cost will likely be at least partially passed on to physicians purchasing insurance.

Tort reform advocates maintain that an increasing frequency of malpractice claims, along with larger jury awards and settlements, are major contributing factors to the rising cost of medical care. Citing anecdotal reports of work stoppages and physicians relocating to regions with lower insurance premiums, they argue that the price

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of liability insurance has now reached levels that are seriously threatening patients' access to health care. In particular, malpractice premiums for high-risk specialties like general surgeons and gynecologists increased rapidly in the early part of this decade (DiRosa, Brennan, D'Souza, Houchins-Witt, & Smith, 2003). Proponents of tort reform suggest that legislation limiting malpractice claims and settlements ultimately leads to cheaper, more accessible health care. If tort reforms successfully reduce malpractice insurance, their impact on physician income will depend on the elasticity of health care demand. If demand is relatively elastic, physicians will be unable to pass on their costs to consumers, and tort reforms that affect malpractice premiums may influence the geographic distribution of physicians. Conversely, many economists believe that because insurance reduces the marginal costs of health care services, demand will likely be fairly inelastic (Baicker & Chandra, 2005). If this is the case, physicians will be able to pass on additional insurance costs to consumers, and tort reforms will have little effect on where physicians choose to practice.

Meanwhile, opponents contend that insurance companies' poor investment decisions, rather than an increase in award sizes or a greater frequency of malpractice claims, have led to the rapid increase in insurance premiums. In particular, declining bond revenues between 1998 and 2001 may have been passed on to physicians in the form of higher premiums (Baicker & Chandra, 2005). According to the Consumer Federation of America, the average payment from malpractice cases has remained constant over the last decade (Hellinger & Encinosa, 2003). Furthermore, state regulations require that malpractice insurance premiums are set in consideration of expected investment return (Hillman & Cluff, 2003). Accordingly, opponents of tort reform claim that high returns during the 1990's allowed insurers to keep rates artificially low, and that the sharp increases in malpractice premium rates at the turn of the century were simply a market adjustment. Rather than improving access to medical care, opponents maintain that damage caps only serve to hurt those patients who are most in the most need (Hellinger & Encinosa, 2003). In particular, these opponents suggest that low-income patients whose payouts mainly consist of noneconomic damages will be hurt by tort reforms, and that those victims may find that they are unable to find a lawyer to take their case.

Regardless of the cause, rising rates have certainly prompted physicians to call for tort reforms that limit malpractice damages. The American Medical Association (AMA) has argued that one of the major determinants of professional liability insurance rates is the size of malpractice awards and that over time insurance will be cheaper in those states which have enacted effective caps on awards in medical malpractice cases (Hellinger & Encinosa, 2003). Moreover, widespread public sentiment that many malpractice cases are filed by greedy people trying to take advantage of the system rather than those who were legitimately injured has solidified support for legislation which puts caps on malpractice damages.

Existing research using OLS regressions by the Agency for Healthcare and Research Quality (AHRQ) has suggested that states that have enacted caps limiting malpractice awards have experienced a higher per capita growth rate of physicians than

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states that have enacted no such reform. The AHRQ proposes that states with caps limiting malpractices awards generally have lower malpractice insurance premiums, leading to a shift in the geographic distribution of physicians. Citing existing work in 1978 by Michael Intrilligator and Barbara Kehner, the AHRQ suggests that state specific statutes that determine the legal conditions of malpractice cases have a significant impact both on the size of malpractice awards and the frequency of claims. As a result, physicians are drawn to practice in states that have enacted tort reforms to limit malpractice awards. The AHRQ's research looks only at the relationship between states with caps versus states without caps limiting malpractice awards, and it does not directly investigate the impact of malpractice premiums on the growth rate of practicing physicians (Hellinger & Encinosa, 2003).

I extend the AHRQ's research by incorporating data from the Medical Liability Monitor, which has information about medical liability insurance rates by state and territories within states for internal medicine, general surgery and OB/GYN specialists. In addition to investigating the effects of noneconomic damage caps on physician supply, I look directly at the impact of medical liability insurance rates on the physician growth rate, and I find evidence that physicians do respond to changing malpractice premiums when choosing where to practice. Furthermore, I examine how noneconomic damage caps affect malpractice payouts and claims, and how the size of malpractice payouts and the frequency of malpractice claims affect medical malpractice premiums. The AHRQ has proposed that noneconomic damage caps cause an increase in physician supply by reducing insurance premiums. Their proposition is that

noneconomic damage caps reduce the size of malpractice payouts and the frequency of malpractice claims, and that in a competitive market this leads to lower malpractice premiums. Using evidence gathered in my investigation about noneconomic damage caps and their effects, I analyze whether the AHRQ's proposed mechanism describing the impact of noneconomic damage caps is reasonable.

Literature Review:

The United States General Accounting Office (GAO) was commissioned to investigate health care providers' responses to rising insurance premiums, because Congress was considering implementing nation wide tort reform. Their report, released in August 2003, examined how tort reform affected the price of malpractice insurance and whether increasing premiums had adversely affected patients' access to health care. The GAO examined growth in malpractice premiums and claims payments at a national level. The GAO did not have access to national data about health care providers' responses to increases in insurance premiums and instead relied on data from five states with reported malpractice problems, such as physicians experiencing difficulty obtaining insurance, higher than average premium growth rates, and accounts of actions taken by providers due to malpractice concerns and increasing premiums (Florida, Nevada, Pennsylvania, Mississippi, and West Virginia). These five states were compared to four states that reportedly did not have high malpractice premium problems (California, Colorado, Minnesota, and Montana). The GAO confirmed anecdotal cases in the five states with reported problems where the growth of malpractice premiums had diminished patient access to health care services. These problems were particularly acute in rural areas, although some providers suggested getting adequate care in rural areas was a persistent problem and not necessarily related to a decrease in available practitioners. The GAO also found that many of the reported cases could not be validated or did not significantly reduce access to health care services. Often, reports of physicians relocating or retiring were untrue or involved too few physicians to substantially affect health care access. These findings were supported by a review of Medicare claims, which did not find any significant usage reduction of high-risk services like orthopedic surgeries or mammograms.

The GAO found that there was evidence, although limited, suggesting that noneconomic damage caps reduced the growth of malpractice premiums. Specifically, premium growth rates throughout the 1990's were slower for general surgery, internal medicine, and OB/GYN specialists in states with noneconomic damage caps. Although the GAO found that claims awards were lower for states with noneconomic damage caps, there was wide geographic variation along with variation across medical specialties. Furthermore, the GAO was unable to determine how much variation in premium levels could be attributed to noneconomic damage caps versus other factors affecting premiums such as the insurer's investment returns, other tort reforms, or the level competition among insurers. Interestingly, although the GAO found that access to health care was not greatly affected by legislation limiting damage awards, the Agency for Healthcare Research and Quality (AHRQ), which also released a report in 2003, found that states that had enacted noneconomic damage caps experienced a larger growth rate of per capita physicians. The authors used ordinary least squares to regress on dummy variables indicating whether or not the state had enacted a cap limiting noneconomic damage awards along with a variety of other controls thought to affect where physicians choose to practice. Some of these factors included: Per capita income, unemployment rates, population density, proportion of elderly citizens, proportion of citizens working in agriculture, physician residency programs, HMO enrollment, and climate.

According to the AHRQ's analysis, states that had enacted noneconomic damage caps experienced a 12% greater increase in physicians per capita than states that did not adopt noneconomic damage caps. A simple comparison showed that before caps were implemented the average number of physicians per 100,000 per county was 69 in states that eventually enacted caps versus 67 in states that did not enact caps. By year 2000 these figures had changed to 135 per 100,000 in states with caps versus 120 per 100,000 in states without caps. Their regression results showed that caps were responsible for 24 more physicians per 100,000 residents as compared to states without a cap¹. The analysis did not include any other laws that might affect physician location decisions.

¹ Statistically significant at a 95% confidence level

In a follow up study, the authors expanded their analysis to include years both before and after the caps were implemented. Using a difference-in-difference approach, the authors sought to examine the effects of caps on physician supply both in urban and rural areas. Using a fixed effects model to control for county differences, the authors regressed the log of physician supply on dummies indicating whether or not the state had a cap during the given year. The authors concluded that most effects occurred three or more years after the caps had been implemented, and that caps were responsible for a 2.18% increase in the supply of physicians within a county. Moreover, the authors found that noneconomic damage caps could increase the supply of surgeons and OB/GYNs in rural areas.

While the existing literature suggests that noneconomic damage caps may have a beneficial effect on the supply of physicians, the mechanism for this increase in physicians is not clear. One possibility is that noneconomic damage caps decrease insurance premiums over time, thus providing incentives for physicians to practice in states that have caps. Another possibility is that the number of claims is reduced because noneconomic damage caps diminish the potential gain from a lawsuit. Finally, if states that implemented noneconomic damage caps are also more likely to have implemented other tort reforms that affect size and frequency of claims, it is possible that the estimated effects of caps from prior research are suffering from omitted variable bias. If the actual effects on physician supply resulted from these other reforms, the estimated effects of noneconomic damage caps may be inflated. My analysis regresses directly on malpractice insurance premiums provided by the Medical Liability Monitor (MLM). Additionally, I include data from the National Practitioner Data Bank (NPDB) to help control for frequency of claims. Finally, I include controls for additional tort reforms to estimate how noneconomic damage caps affect physician supply on a state specific basis.

Theoretical Framework:

The underlying theoretical framework of this analysis is that physicians try to minimize their exposure to malpractice suits by locating in states where legislation is more favorable. In particular, states with noneconomic damage caps should generally have lower premiums than states without noneconomic damage caps. The reason for the lower premiums is twofold. First, if insurance companies face lower payouts as a result of noneconomic damage caps and the market for professional liability insurance is competitive, premium levels will fall accordingly. Second, the frequency of malpractice claims may be reduced through noneconomic damage caps since the potential payout for both plaintiffs and lawyers is reduced. Lower insurance premiums and reduced frequency of claims may both provide better incentives for physicians to practice in a given area.

The demand for health services likely also plays a role in the geographic distribution of physicians. Areas with a higher proportion of insured citizens, higher per capita income, lower unemployment rates, and a larger proportion of older citizens are expected to have a larger demand for physicians.

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Additionally, parameters typically identified in general migration models will likely be important factors in the flow of physicians. Moving costs, distance, expected income, and population effects are likely to play a role in physicians' migration decisions (Kennan & Walker, 2003). It is anticipated that moving costs are likely higher for physicians that are already established, and it may be more informative to look at the location decisions of new or younger physicians when evaluating the effects of tort reform. In addition to affecting demand conditions, population may have an effect on location decisions as a person is more likely to have a friend or relative in more populous areas (Kennan & Walker, 2003). Similarly, previously living in a certain area has strong effect on migration decisions (Kennan & Walker, 2003). Consequently, home, school, and residency program locations will likely be important factors in determining where physicians choose to practice.

Data:

The data for this study comes from four sources. The first, the Area Resource File (ARF) is a national, county-level database containing information about health facilities, health professions, economic activity, and health training programs. The ARF is a compilation of several sources including the AMA, the American Hospital Association, the US Census Bureau, Centers for Medicare and Medicaid Services, the Bureau of Labor and Statistics, and the National Center for Health Statistics. The ARF is used to determine the number of practicing physicians in specific areas, as well as control for important demographic factors that may affect physician supply and vary with geography such as employment levels, income levels, and health training facilities.

The second data source, the National Practitioner Data Bank (NPDB) is a registry maintained by the U.S. Department of Health and Human Services (National Practitioner Data Bank Public Use Data File, 2009). Medical malpractice payers are required to report payments to the NPDB under the Health Care Quality Improvement Act of 1986 (Baicker & Chandra, 2005). The reliability of the NPDB has come under question by both the Physician Insurers Association of America (PIAA) and the GAO for a number of different reasons. First, the NPDB only includes information on claims payments themselves, and not the administrative costs involved in settling a claim (Kessler, 2006). Second, the PIAA has charged that the NPDB has suffered from underreporting problems that have been growing over time (Kessler, 2006). According to the GAO, the NPDB suffers from a "corporate shield" that exempts the inclusion of payments by hospitals and other corporations when individuals filing the claim remove the practitioner's name from the claim, and instead name the hospital or corporation as responsible (Redican-Bigott & Harris, 2000). Despite these shortcomings, the NPDB is likely the best estimate available for size and frequency of malpractice claims.

The Medical Liability Monitor's (MLM) rate survey is used to estimate medical liability insurance rates. The MLM's rate survey collects information about insurance rates from major insurers across the United States. According to the MLM, the rate survey represents between 65 to 75 percent of the medical liability insurance market (Karls, 2008). The survey reports rates by state and territories within states and by insurer for internal medicine, general surgery and OB/GYN specialists. The rate survey also contains information about patient compensation funds (Karls, 2008). Patient

compensation funds (PCFs) provide coverage for malpractice awards above a predefined amount. PCFs are funded by surcharges on medical practitioners, thus PCFs have the potential to affect both malpractice premiums and physicians' income. The MLM's rate survey is used to estimate the price of malpractice insurance across different regions, as well as control for the existence of PCFs by adding the PCF surcharges to malpractice rates.

The rate survey is not available in electronic format. I converted the MLM's insurance rate estimates into an electronic format by hand-entering the insurance rate information for each of the three available medical specialties for the 3143 counties in the US from 1996 to 2006. When rate information was not available at the county level, I used the U.S. Census Bureau's historical Metropolitan and Micropolitan Statistical Areas for the appropriate year to cross-reference cities to their appropriate counties.² Not all insurance companies consistently report their rates in the MLM every year. To prevent trends in insurance premiums from being obfuscated by irregular reporting, one insurance company from each state was chosen to represent changing malpractice premiums. The downside to this approach is that it does not fully represent the malpractice insurance market. Generally, however, the insurance rates for all companies represented in the MLM tend to move together, and selecting a single company likely provides a good approximation. Company selection was based on whether the company reported rates for the entire 1996-2006 year time span and how specifically the company reported regional insurance rates. Companies with more

 $^{^2}$ The US Census Bureau's definitions from 1993 were used for years 1996 to 1998; definitions from 1999 were used for years 1999 to 2006.

specific reporting were preferred.

Finally, information about noneconomic damage caps was gathered from reports by the American Medical Association, the American Tort Reform Association, and the McCullough, Campbell & Lane LLP law firm ("Caps on Damages," 2008; McCullough, 2007; Noneconomic Damages Reform," 2007; Tort Reform Record," 2009). Tort reform information was gathered manually and hand entered for the 50 states and the District of Columbia for the years 1991 to 2006.

Empirical Specification:

This investigation (if noneconomic damage caps induce growth in physician supply through reducing malpractice premiums) comes in two parts. The first part investigates whether physicians do indeed respond to insurance premiums when making decisions about where to practice. Furthermore, it looks at the effects of noneconomic damage caps both controlling for and not controlling for insurance premiums to see if the apparent effects of noneconomic damage caps on physician supply are mediated by insurance premiums as other researchers have suggested. The second part will look directly at how insurance premiums respond to noneconomic damage caps. Moreover, this second part looks at how noneconomic damage caps affect payouts and frequency of malpractice claims because these are the main mechanisms suggested for how noneconomic damage caps could affect malpractice premiums. The first part of this investigation uses the following fixed effects model to estimate the effects of tort reforms and insurance prices on physicians' decisions about where to practice on the county level:

$$\Delta log((physicians+1)/population)_{it} = \beta_0 + \beta_1 * \Delta Insur_{it} + \beta_2 * Cap300_{it} + \beta_3 * Cap600_{it} + \beta_4 * CapGr600_{it} + \beta_5 * \Delta log(hospital admissions+1)_{it} + \beta_6 * \Delta \% Elderly_{it} + \beta_7 * \Delta log (Per capita income)_{it} + \beta_8 * \Delta Unemployment_{it} + \beta_9 * \Delta (doctors sued/total physicians) + \varepsilon_{it}$$

This regression is run separately for internists, surgeons, and OB/GYN specialists. The independent variable is the percent change (approximated by a difference in logs) in the number of physicians divided by the population in that county. The number of physicians is adjusted by population so that the coefficients can be interpreted as the percent change in the supply of physicians per person rather than the percent change in physicians in the county. The number of physicians and the number of hospital admissions are defined as "physicians plus one" and "hospital admissions plus one" so that these observations will not be dropped when there are no practicing physicians in the county or when there is not a hospital in the given county. Insur indicates the malpractice premiums as listed by the Medical Liability Monitor for the appropriate medical specialty in the county for that year. The *Cap* variables indicate whether there was a noneconomic damage cap of \$300,000 or less, \$600,000 or less, or greater than \$600,000 respectively. *Per capita income* is the per capita income in that county in that year. %Elderly is a measure of the percentage of the population in that county that is of age 65 or older. Unemployment is the unemployment rate in that county in that year (doctors sued/total physicians) is the number of unique doctors successfully sued in a state in a given year according to the NPDB divided by the total number of practicing physicians in that state.

It is meant to proxy the approximate probability that a doctor will get sued in a given year. Note that this proxy underestimates the probability of being sued since it only represents successful malpractice claims, and possibly further underestimates the probability of being sued due to NPDB underreporting problems. Thus the coefficient of this estimate may be inflated and, to the extent that the proportions of successful claims or NPDB underreporting problems change over time, it is possible that it may be biased. Ideally, average payouts per doctor could have also been included in this regression in order to investigate whether physician supply responds to large malpractice payouts in certain areas. Unfortunately, payout amounts from the NPDB are only available at the state level and thus were omitted from this regression.

It is anticipated that greater demand conditions will lead to a greater supply of doctors. Percent elderly, per capita income, and hospital admissions are all expected to lead to greater demand for physicians, and accordingly, to carry positive signs in the regression. Because general migration models suggest that previously living in an area increases the likelihood of moving there, hospital admissions may have an additional positive effect on physician supply since physicians will have previously lived in counties that have hospitals with residency programs. Higher insurance rates are expected to reduce physician supply through reducing physician income and thus are expected to carry a negative sign. Noneconomic damage caps are expected to induce physicians to practice in the areas in which they are implemented and are expected to have a positive sign. Because being sued carries both economic and noneconomic costs, the number of doctors sued adjusted by the total number of practicing physicians is

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anticipated to have a negative sign.

The first part of this investigation runs this regression in three scenarios. The first scenario looks directly at the effects of insurance premiums on the supply of physicians without the keeping cap variables in the equation. Previous literature has suggested that the main ways that noneconomic damage caps induce increases in physician supply is by reducing insurance premiums and reducing the probability that physicians will get sued. The first regression investigates this relationship directly of internists, surgeons, and OB/GYN specialists. The second set of regressions looks only at the cap variables and omits insurance premiums and the probability of getting sued. This set of regressions is meant to look at the relationship of noneconomic damage caps on physician supply in the same manner as previous literature, which did not control for malpractice premium rates or the probability of getting sued. Because noneconomic damage caps may take some time before they have their intended effects, this model was run contemporaneously with noneconomic damage cap indicators, as well as with the indicators lagged one, three and five years. Finally, this model is run a third time, this time including cap variables and insurance at the same time. If the impact of noneconomic damage caps is significant even after controlling for changes in malpractice premiums, it suggests that an alternative mechanism is needed to explain why noneconomic damage caps appear to increase the supply of physicians in an area. Such a scenario may indicate that damage caps confer some additional amount of psychic utility to physicians (for example, peace of mind about not being liable for an amount beyond their insurance policy) in excess of the benefits of higher income through lower insurance

rates. For all the regressions in this paper the monetary variables were adjusted for inflation to reflect their dollar value in 2006. This procedure was particularly important because in many states damage caps are not indexed to inflation. Also, in all regressions insurance premiums and hospital admissions were lagged one year in order to prevent endogeneity.

The second part of this investigation looks directly at the impact of noneconomic damage caps on malpractice insurance rates. This part of the investigation is performed in three stages. The first stage of the investigation uses the following fixed effects regression on the state level:

 $\Delta log(average \ insurance \ rate)_{it} = \beta_0 + \beta_1 * \Delta Treasury 10_{it} + \beta_2 * Cap 300_{it} + \beta_3 * Cap 600_{it} + \beta_4 * Cap Gr 600_{it} + \beta_5 * \Delta log(Avg \ \# \ of \ Claims)_{it} + \beta_6 * \Delta log(Avg \ payouts \ per \ doctor)_{it} + \varepsilon_{it}$

This stage is meant to investigate directly how malpractice premiums respond to noneconomic damage caps. Because this regression includes controls for the average number of claims and the average number of payouts, the coefficients on the cap variables should primarily reflect additional benefits that caps confer beyond reducing payout size and claim frequency. Specifically, since it is hypothesized that noneconomic damage caps may lead to lower malpractice premiums by reducing insurer uncertainty about the size of malpractice payouts and frequency of malpractice claims, the cap variables in this regression will capture those effects. The average insurance rate in a given state was calculated as a weighted average of the malpractice insurance rates provided by the MLM in each county, and the rates were weighted by the total number of practicing physicians in that county divided by the total number of practicing physicians

in that state. Treasury 10_t is meant to estimate the interest rates faced by insurance companies by using the interest rates of 10-year US treasury bonds. Again, the Cap variables represent noneconomic damage caps of less than \$300,000, \$600,000, and greater than \$600,000 respectively. Avg # of Claims is the average number of successful claims per doctor in a given state in a given year. The number total number of claims was calculated from the NPDB and was divided by the total number of practicing physicians as calculated from the ARF. Avg # of Claims only includes successful claims (as the NPDB only includes successful claims). Because insurance companies bear costs processing and defending claims for both successful and unsuccessful claims, Avg # of *Claims* is an imperfect representation of the costs faced by malpractice insurers. Because Avg # of Claims underestimates the total number of claims an insurance company has to process and defend, its estimated coefficient may be inflated. Avg payouts per doctor is the average number of payouts per doctor calculated by summing the total number of payouts in a given state in a given year as provided by the NPDB and dividing it by the total number of practicing physicians as calculated from the ARF. Because it may take time before insurance companies adjust to changing tort laws and interest rates, this regression was run lagging the covariates for one, three, and five years. This process was repeated three times to separately estimate the effects of noneconomic damage caps on malpractice rates for internists, surgeons, and OB/GYNs.

The second and third stages examine how noneconomic damage caps affect the number of claims filed and the size of payouts because these are presumed to be major costs faced by malpractice providers and thus likely determinants of malpractice

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insurance rates. The second stage of the investigation uses the following fixed effects regression on the state level:

 $\Delta log(average \ payouts \ per \ doctor)_{it} = \beta_0 + \beta_1 * Cap 300_{it} + \beta_2 * Cap 600_{it} + \beta_3 * Cap Gr 600_{it} + \beta_4 * JSL_{it} + \beta_5 * CSR_{it} + \beta_6 * PDC_{it} + \varepsilon_{it}$

This stage is meant to estimate the effects of noneconomic damage caps on the average payouts per doctor. The average payouts per doctor was calculated using the total payouts in a state in a given year as provided by the NPDB, and the total number of practicing doctors in the state was calculated by summing total number of practicing physicians in all the counties in that state as provided by the ARF. The *JSL*, *CSR*, and *PDC* variables are indicators to control for other tort reforms. These indicators represent whether the state had tort reforms in place for joint and several liability, the collateral source rule, and a punitive damage cap in that year. A specific control for patient compensation funds was not included because no states introduced PCFs during the time period in question (Sloan, Mathews, Conover, & Sage, 2005). Thus, fixed effects should capture the existence of a PCF. Again, because these reforms may take time before they take effect, this regression was run lagging the tort reforms one, three, and five years.

The third stage of this analysis is meant examine how tort reforms affect the number of claims per doctor and uses the following fixed effects regression at the state level:

 $\Delta log(average \ claims \ per \ doctor)_{it} = \beta_0 + \beta_1 * Cap 300_{it} + \beta_2 * Cap 600_{it} + \beta_3 * Cap Gr 600_{it} + \beta_4 * JSL_{it} + \beta_5 * CSR_{it} + \beta_6 * PDC_{it} + \varepsilon_{it}$

Like in the second stage, this model is run with covariates lagged for one, three, and five years. Again, because the NPDB only represents successful claims, certain caveats apply to this analysis. None of the tort reforms shown here are meant to specifically target whether a malpractice lawsuit is successful or not, but if the proportion of successful lawsuits in a given state changes due to these reforms or for other reasons, these estimates may not be valid.

Results:

The results of the first model³ show that malpractice premiums play an important role in mediating surgeons' and OB/GYN specialists' location decisions. A \$10,000 increase in malpractice premiums was associated with approximately a 0.5% decrease in the supply of surgeons per person (p=.005). Similarly, a \$10,000 increase in the cost of malpractice insurance for OB/GYN specialists was associated with a 0.6% decrease in the supply of OB/GYNs per person (p=.001). No statistically significant relationship was found between internists' location decisions and malpractice premiums. Internists tend to face much lower malpractice premiums than either surgeons or OB/GYNs, and their rates are considerably less volatile. Thus, it is perhaps unsurprising that surgeons and OB/GYNs are more concerned with malpractice rates than internists when choosing where to practice.

Hospital admissions, percent elderly, and unemployment all affected physician location decisions to varying degrees. For internists and surgeons a 1% increase in hospital admissions in the previous year was associated with approximately a 2% increase in physician supply (p<.001 for both). For OB/GYNs the relationship was positive, but not statistically significant. The percentage of people over 65 in the county

³ Results are similar to the results in table 1 and are not shown

was also positively associated with an increase in physician supply. The relationship was statistically significant for surgeons and marginally significant (p=.08) for internists. A 1% increase in the percentage of people in the county over 65 was associated with about a 1% increase in the supply of internists and a 1.5% increase in the supply of surgeons (p=.08 and p=.043). Surprisingly, the relationship between the unemployment rate and physician supply was positive and statistically significant for both internists and OB/GYNs (p=.013 and p=.022). It is not entirely clear why the supply of internists and OB/GYNs tends to have a positive relationship with unemployment. One possible explanation is that if unemployment is high enough, increased demand from Medicare and Medicaid patients will be enough to induce growth in the physician supply. Alternatively, if unemployment tends to rise in areas as they become more metropolitan, to the extent that doctors prefer to practice in urban areas it may appear as though the relationship between unemployment and physician supply is positive.

The most important factor determining physician supply both in terms of the magnitude of its influence and statistical significance is the county per capita income. A 1% increase in per capita income is associated with a 17% increase in the supply of internists (p<.001), a 25% increase in the supply of surgeons (p<.001), and a 14% increase in the supply of OB/GYNs (p<.001). The magnitude of the effect of per capita income raises an important question about the impact of malpractice premiums on the supply of surgeons and OB/GYNs. Although the effects of malpractice premiums are statistically significant in determining where physicians choose to practice, the magnitudes of their effects are fairly small. From a policy perspective, trying to induce new surgeons and OB/GYNs to practice in a certain area by implementing policies to reduce malpractice premiums may be impractical. A fairly large decrease of \$10,000 in malpractice premiums is associated with only a modest 0.5-0.6% increase in surgeons and OB/GYNs. Physicians seem to be far more concerned with living in comfortable and prosperous areas than finding the cheapest malpractice rates. Thus resources may be better spent trying to improve living conditions than reduce malpractice premiums if their purpose is to induce growth in physician supply.

In the second model, no noneconomic damage caps were significant when they were not lagged or when lagged for only one year.⁴ Moreover, when not lagged or lagged for one year many of the coefficients for the noneconomic damage caps were negative. After lagging for 3 or 5 years most of the signs on the cap coefficients became positive. These results indicate that it is likely that most of the new non-economic damage caps were passed during the period of high malpractice premium growth in the early 2000's, a so called "malpractice crisis", and that it takes some time before the caps become effective.

The strength of the effects of non-economic damage caps on supply of the three medical specialties mirrored the effects of malpractice premiums. Caps were not immediately statistically significant for internists, or when lagged for one, three, or five years. Again, a lower probability of being sued coupled with lower malpractice premiums likely diminishes the impact of non-economic damage caps on internists. The \$300,000 or less and \$600,000 or less non-economic damage caps were statistically

⁴ Results are similar to the results in table 1 and are not shown

significant for surgeons after three years, and the effects persisted when lagged for five years. After three years a cap of \$300,000 or less was associated with approximately a 4% increase in the supply of surgeons (p=.027) and a cap of \$600,000 or less with approximately a 3% increase (p=.018). After five years the effects were even stronger with approximately a 4% increase in the supply of surgeons for both \$300,000 or less and \$600,000 or less caps. Caps for OB/GYN specialists did not show a statistically significant relationship after lagging for three years, but the \$300,000 or less cap did show marginal significance (p=.06) after five years and was associated with approximately a 3% increase in the supply of OB/GYNs. Interestingly, non-economic damage caps of greater than \$600,000 showed a negative relationship of marginal significance (p=.075) with the supply of OB/GYN specialists. These results are consistent with the results of William E. Encionsa and Fred J. Hellinger which show that non-economic damage caps with high limits are relatively ineffective at inducing physician supply. Furthermore, they bolster the positions of the American Tort Reform Association and the AMA who both support noneconomic damage caps with low limits.

After controlling for malpractice premiums the effects of the \$300,000 or less and \$600,000 or less non-economic damage caps after three years for surgeons change to marginal significance (p=.081 and p=.080) and the magnitude of their point estimates is slightly reduced. As shown in table 1, after five years the magnitude of the effects of these caps was slightly increased and they entered with slightly higher significance than before. Similarly, after five years the \$300,000 cap for OB/GYNs, which was of marginal significance, becomes significant after controlling for malpractice premiums, and the \$600,000 or less cap, which was insignificant before controlling for insurance, becomes significant.

Table 1 Combined effects of malpractice premiums and noneconomic damage caps on
physician supply. Caps lagged 5 years. 1997-2006.

	Physician Supply		
	Internists	Surgeons	OB/GYNs
Malpractice premiums (in \$10,000)	-0.0112	-0.0047***	-0.0054***
	(0.0086)	(0.0018)	(0.0019)
NE damage cap<\$300,000	-0.0006	0.047**	0.0389**
	(0.0230)	(0.0202)	(0.0181)
NE damage cap<\$600,000	0.0230	0.0468***	0.0231*
	(0.0172)	(0.0149)	(0.0132)
NE damage cap>\$600,000	0.0205	0.0105	-0.0144
	(0.0138)	(0.0113)	(0.0109)
Hospital Admissions	0.0192***	0.0168***	0.0044
	(0.0055)	(0.0046)	(0.0048)
% of population over 65	0.0115*	0.0145**	0.0081
	(0.0067)	(0.0073)	(0.0057)
Per capita income	0.1653***	0.2417***	0.1355***
	(0.0486)	(0.0391)	(0.0328)
Unemployment rate	0.0047**	0.0021	0.0032**
	(0.0019)	(0.0017)	(0.0015)
Year FE			
County FE			
	Adj $R^2 = 0.89$	Adj R ² = 0.91	Adj $R^2 = 0.93$
	N = 30386	N = 30386	N = 30386

Note 1: Effects of caps on surgeon and OB/GYN supply remain even after controlling for malpractice premiums.

Note 2: Robust standard errors shown in parentheses. All standard errors have been adjusted for clustering.

*= P<0.10 **= P<0.05 ***= P<0.01

The fact that the effects of noneconomic damage caps are fairly consistent even after controlling for the cost of malpractice insurance and that these effects tend to maintain or even increase their influence on physician supply across internists, surgeons, and OB/GYNs suggests that malpractice premiums may not be the only or even the main mediating effect driving physician supply in the presence of noneconomic damage caps. One possibility is that physicians are indeed concerned that they may be sued for an amount beyond their insurance coverage and that they will be personally liable for further damages. In this case, noneconomic damage caps may provide some psychological benefits to physicians that are not captured by insurance premiums. Alternatively, the direction of causality between noneconomic damage caps and physician supply is not clear. It is possible that a strong AMA presence and physician's lobby brought about by a larger body of physicians leads to tort reform favoring physicians. Thus, tort reforms could be the result of an increasing supply of physicians rather than the cause. While still possible, this theory is somewhat discredited because non-economic damage caps tend to enter regression results with negative signs when looked at contemporaneously, and their positive effects on physician supply are only seen after a few years.

As shown in table 2, results of the regressing insurance rates on noneconomic damage caps are consistent with the idea that the effects of noneconomic damage caps on physician supply are mainly not a result of their effects on malpractice premiums. The results remained stable even when omitting either the cap variables or claims per doctor and payouts per doctor. This stability suggests both that the effects of noneconomic damage caps on malpractice premiums are relatively independent from the

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effects of frequency of malpractice claims and size of payouts and that this model did not suffer from problems of endogeneity. Interest rates, estimated by interest rates on 10year treasury bonds, had the largest impact on the malpractice premiums faced by physicians. Corresponding with the results of noneconomic damage caps on physician supply, noneconomic damage caps all entered with a positive sign when only lagged for one year, suggesting that they were passed during times of high insurance premium growth, and that it takes time before they have an effect on insurance premiums.⁵ None of the noneconomic damage caps were statistically significant in determining changes in physician premiums. These results suggest that noneconomic damage caps do not lower insurance premiums by reducing insurer uncertainty about the frequency of claims or size of payouts. Although not conclusive, there is limited evidence that average payouts may affect malpractice premiums. When lagged for three years, a 1% increase in average payouts was associated with a 9% increase in premiums for internists (p=.069) and a 12% increase in premiums for OB/GYNs (p=.021). Nonetheless, the consistent statistical significance of interest rates on malpractice premiums supports the theory that the high growth rate of premiums in the early 2000's was mainly driven by changing economic conditions and the investment decisions of insurance companies rather than an influx of malpractice lawsuits or escalating malpractice payouts.

⁵ Only results for 5 year lag are shown. Interest rates were statistically significant at p<.01 for all three specialties for 1 year, 3 year, and 5 year lags. All other variables were insignificant in 1, 3, and 5 year models, with the exception of payouts with a 3 year lag, as noted above.

	Premiums		
	Internists	Surgeons	OB/GYNs
Interest rate 10-yr T-bond	-0.3351***	-0.2966***	-0.3234***
	(0.0353)	(0.0348)	(0.0353)
NE damage cap<\$300,000	-0.0331	-0.0578	0.0233
	(0.1411)	(0.1283)	(0.1338)
NE damage cap<\$600,000	0.0396	-0.0399	0.0381
	(0.1158)	(0.1098)	(0.1225)
NE damage cap>\$600,000	0.1250	0.0377	0.1043
	(0.1111)	(0.0920)	(0.1085)
Claims per doctor	0.1293	0.1240	0.0854
	(0.0814)	(0.0915)	(0.0872)
Payouts per doctor	0.0133	-0.0166	0.0127
	(0.0434)	(0.0458)	(0.0420)
Year FE			
State FE			
	N = 306 Adj $R^2 = 0.92$	N = 306 Adj R^2 = 0.92	N = 306 Adj R ² = 0.93

Table 2 Effects of interest rates, noneconomic damage caps, claims, and payouts onmalpractice premiums. Variables lagged five years. 2001-2006

Note 1: Interest rates have a stronger influence on malpractice premiums than noneconomic damage caps.

Note 2: Robust standard errors shown in parentheses. All standard errors have been adjusted for clustering.

*= P<0.10 **= P<0.05 *** = P<0.01

As shown in table 3, the results of regressing average payouts per doctor on various tort reforms suggests that non-economic damage caps do have a significant effect on payouts and that these effects materialize fairly quickly⁶. While it takes some time before malpractice premiums adjust to new legislation, the impact on payouts happens immediately. After one year, non-economic damage caps of \$300,000 or less

⁶ Results for 3 year and 5 year lag not shown. Caps of \$300,000 or less are still significant after 3 year lag and are associated with a 31% decrease in payouts. No tort reform caps are significant after 5 years.

are associated with a 34% reduction in average payouts per doctor (p=.013), an 18% reduction for caps of \$600,000 or less (p=.009), and 22% for caps of \$600,000 or more (p < .001). There is also some evidence, albeit limited, that noneconomic damage caps reduce the number of successful claims. Noneconomic damage caps of \$300,000 or less are marginally significant (p=.093) and are associated with a 13% reduction in the number of claims after one year. After three years, this effect is statistically significant and it rises to a 20% reduction in the number of claims (p=.017). A cap of greater than \$600,000 is associated with a 10% decrease in the number of claims after three years (p=.045), and an 11% decrease in the number of claims after five years (p=.038). The response time of the number of successful claims to noneconomic damage cap tort reform may be slower than that of the response of payouts because it takes lawyers time to adjust their practices to the new laws. As noneconomic damage caps are implemented, lawyers may be less willing to take on malpractice cases for low wage earners as most of the payouts would have to come from damages other than from lost revenue. Because noneconomic damage caps seem more effective at reducing malpractice payouts than reducing malpractice claims, and because there are some indicators that average payout sizes may affect malpractice premiums, the best available evidence suggests that if noneconomic damage caps do induce growth in physician supply by reducing malpractice premiums, they do so mainly by reducing payout size rather than frequency of claims.

	Payouts per doc	Claims per doc
NE damage cap<\$300,000	-0.3400**	-0.1383*
	(0.1323)	(0.0806)
NE damage cap<\$600,000	-0.1754***	0.0110
	(0.0640)	(0.0469)
NE damage cap>\$600,000	-0.2175***	-0.0334
	(0.0573)	(0.0502)
JSL reform	0.1311**	0.0656
	(0.0643)	(0.0558)
Collateral source rule	0.0530	0.1749
	(0.1400)	(0.2697)
Punitive damage cap	-0.0829	-0.0809
	(0.0635)	(0.0597)
Year FE		
State FE		
	Adj $R^2 = 0.61$	Adj $R^2 = 0.80$
	N = 561	N=561

Table 3 Effects of noneconomic damage caps and other tort reforms on the size andfrequency of malpractice payouts. Reforms lagged 1 year.1996-2006

Note 1: Effects of noneconomic damage caps and other tort reforms on average malpractice payouts. Reforms lagged 1 year. 1996-2006

Note 2: Robust standard errors shown in parentheses. All standard errors have been adjusted for clustering

*= P<0.10 **= P<0.05 *** = P<0.01

Discussion:

This study has a number of important limitations. First, there are other factors that are likely to affect physician supply. Perhaps most importantly, an income estimate for the specific specialties investigated here was not available. To some degree, different physician income levels will be captured by average per capita income, but a more specific estimate would have been more appropriate. An effort was made to gather income estimates from the Occupational Employment Statistics program's state cross-

industry estimates. However, because most physicians make well above the average per capita income, in many years for many states the survey only provided an indicator signifying that the particular annual income for the relevant medical specialists was above a certain threshold instead of a specific estimate. These missing values represented approximately 35% of the available observations. Because of this missing not at random data, reliable estimates could not be produced.

Another concern in this study is the controls used for tort reforms. Although more tort reforms were controlled for in this study than in previous studies, tort reforms vary widely from state to state and thresholds and indicator variables likely do not adequately capture all of their nuances.

An additional limitation of this study is that it may not adequately capture the effects of tort reforms on malpractice insurance if insurance providers use historical data to predict future claims and payouts and only gradually change their rates over time in response to these data. This study makes attempts to compensate for delayed effects of tort reform by lagging tort reform variables, but if insurance companies tend to try and spread out rate increases over time, the methodology in this study may not be satisfactory, and a long difference approach may be more appropriate. However, the high volatility of rates in the early 2000's suggests that insurance companies are not averse to changing rates quickly⁷, and that simply lagging controls for tort reforms is satisfactory.

⁷ For example, over 30% of the observed rate changes in malpractice premiums for surgeons from 1996 to 2006 were of a magnitude greater than 10%, and some were greater than 100%

There does indeed seem to be a relationship between malpractice premiums and where physicians choose to practice at least among specialties with high insurance premiums. The direct investigation of how physician growth rates respond to both noneconomic damage caps and malpractice premiums shows that it is not clear that noneconomic damage caps exploit this relationship to create growth in physician supply. Nonetheless, there is some evidence, although not conclusive, that noneconomic damage caps are associated with growth in physician supply.

The proposed mechanism for how malpractice premiums might stimulate growth in physician supply was that they would reduce the number of claims filed, or overall malpractice payouts, or both. The results of the investigation of the effects of noneconomic damage caps on payouts and claims show that there is some evidence that noneconomic damage caps reduce a physician's probability of being sued, and there is even better evidence that they reduce average payout per physician. However, malpractice premiums appear to have a fairly tenuous relationship with the number of malpractice claims filed and their associated payouts. The relationship between malpractice premiums and interest rates is much stronger, and it appears more likely that this was the driving force behind increases in malpractice premiums in the latest "malpractice crisis" in the early 2000's. Like the direct investigation of the effects of noneconomic damage caps on physician supply, this finding supports the theory that noneconomic damage caps do not decrease malpractice premiums in such a way that they will exhibit a strong influence on physician supply through these mediating effects.

The policy implications of these findings are that if the main goals of noneconomic damage caps are to reduce malpractice premiums they will likely be ineffective. Moreover, because there is evidence that noneconomic damage caps reduce the average payout per doctor and the number of malpractice claims filed, it is possible that these caps needlessly reduce merited malpractice claims. However, these are not the only stated goals of noneconomic damage caps, and in particular noneconomic damage caps may still be an effective tool in reducing the practice of defensive medicine and overall healthcare costs. Future research should focus on whether noneconomic damage caps achieve these purposes.

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