Note to workshop participants:

Thank you for taking the time to read this very early draft, which contains an outline of one study of a number that I hope to produce using a dataset of medical malpractice premiums (currently under construction). I apologize for the lack of completeness and obvious gaps. You'll see that this is a true work in progress—it's currently an empirical paper with no data. I'm hoping to be able to reveal some preliminary results using a partial dataset during the talk. Your comments and suggestions related to data collection and estimation strategies will be most helpful at this very early stage. Thank you in advance for your input.

Kathy

The Impact of Damages Caps on Medical Malpractice Insurance Premiums

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Abstract

*We explore the association between state variation in statutory damages caps and the price of medical malpractice insurance. We improve on previous studies by using a comprehensive dataset of insurance premiums constructed from state department of insurance filings. We also control for the possibility that caps are endogenous to trends in premiums. We estimate an average X% change in medical malpractice insurance premiums following the implementation of non-economic damages caps. The passage of a cap on punitive damages is followed by a X% change in premiums. These findings suggest that [*insert conclusion*]*. (JEL G22, I18, K13)

[‡] Nancy Barton Scholar and Professor of Law, Boston University School of Law. kzeiler@bu.edu. I am grateful for comments from and discussions with [*insert names*] and seminar participants at the law schools of Boston University, George Mason University, Northeastern University, Northwestern University, University of Toronto, University of Virginia, [*insert other schools*]. I'm grateful for the financial support of George Mason University's Law and Economics Center, which funded the collection of medical malpractice insurance premiums data. The Center's Board of Directors and James Cooper, Director of Research and Policy, provided useful comments and advice along the way.

Introduction

Since 1975, when the California legislature passed one of the first caps on non-economic damages recoverable by injured patients in medical malpractice cases against physicians,[1] XX other states have passed similar caps on economic, non-economic and/or punitives damages (Avraham, 2014). Then Governor of California Jerry Brown, a supporter of the cap, argued "[t]he inability of doctors to obtain insurance at reasonable rates is endangering the health of the people of this State, and threatens the closing of many hospitals."[2] Similar arguments were raised during the court battle over the cap's constitutionality[3] and during the debates that preceded the 2014 referendum vote to raise the cap from $250,000 to $1.1 million and to tie it to inflation in subsequent years.[4]

The standard theory behind the impact of caps on medical malpractice insurance premiums assumes that caps will make it less likely for injured patients to file medical malpractice claims.[5] In addition, the theory predicts that those who do decide to pursue malpractice claims will recover less in damages payments through both judgment and settlement. Assuming the claim rate and the average payment both decrease, the theory predicts that total losses paid by malpractice insurers will decrease. If insurance markets are competitive, this reduction in losses will result in lower insurance prices.

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[1] Medical Injury Compensation Reform Act (MICRA), ch. 1, 1975 Cal. Stat. 3949 (codified as amended at CAL. CIV. CODE § 3333.2 (West 1997)). Three types of damages are recoverable in tort suits. Economic damages compensate injured patients for past and future medical costs, past and future wages and other economic losses. Non-economic damages compensate for pain, suffering, loss of consortium and other non-pecuniary losses. Punitive damages are sometimes awarded to punish especially egregious physician behavior.

[2] Jerry Brown, Emergency Proclamation (1975).

[3] [add statements made during debates] California's cap on non-economic damages was held constitutional in Fein v. Permanente Medical Group 38 Cal.3d 137 (Cal. 02/28/1985), vacating the opinion of 175 Cal.Rptr. 177 (Cal.App. 3 Dist., 6/30/1981) (upholding the cap as constitutional). The cap was consequently held constitutional in Hoffman v. U.S., 767 F.2d 1431 (9th Cir. 8/9/1985); Flores v. Natividad Medical Center, 238 Cal.Rptr. 24 (Cal.App. 1 Dist., 6/22/1987); Yates v. Pollock, 239 Cal.Rptr. 383 (Cal.App. 2 Dist., 8/19/1987); Jordan v. Long Beach Community Hosp., 248 Cal.Rptr. 651 (Cal.App. 2 Dist., 6/10/1988).

[4] [add statements made during campaign] "Consumers Seek to Raise California Cap on Malpractice Awards," New York Times, March 24, 2014.

[5] See *infra* Part I for a summary of the theoretical literature.

More complex theories take into account caps' second-order effects and other features of the environment that limit the applicability of the standard theory. These include the impacts of medical malpractice insurance policy limits on damages payments, changes following the passage of caps in plaintiff attorneys' strategies over how to present damages during settlement negotiations and trial, and reactions of physicians to caps when deciding whether to take costly precautions in the face of reduced exposure to liability for patient injuries. These more complex theories produce nuanced and often ambiguous predictions about the impacts of caps on premiums.

In the face of these varied theoretical predictions, scholars have employed empirical methods to estimate the impacts of caps on premiums. To date, researchers have produced sixteen studies that report estimates derived from 197 regression analyses (Zeiler and Hardcastle, 2013). The estimates vary widely. While roughly 3 out of every 10 estimates suggest that caps produce the intended effect (at a 10% significance level), the majority of results fail to reject the null hypothesis of no effect.

The wide variation in results likely is due, at least in part, to differences in the data and methods employed to produce them.[6] The studies employ different proxies for premiums, different sources of premiums data, different sources of data related to damages caps and other types of tort reforms, different controls, different time periods, different sample sizes, different levels of observation, and various empirical models. Given the wide variation in a substantial number of features and the limited number of estimates, identifying the drivers of the differences in results using quantitative methods such as meta-analysis is impossible.[7]

One useful lesson gained from a close look at previous studies, however, is that each study comes with limitations.[8] Three limitations are especially widespread across the existing studies. First, premium data have been notoriously difficult to obtain, and researchers have resorted to using less-than-ideal data to develop measures of the price of medical malpractice insurance. Second, none of the existing studies controls for possible simultaneity—the likelihood that legislative moves to impose damages caps are triggered

[6] See *infra* Part II for a detailed summary of the existing empirical literature.

[7] [define meta-analysis and point to source]

[8] Zeiler and Hardcastle (2013) summarize the limitations of the existing literature in detail.

by pre-cap trends in premiums. If trends in premiums cause states to impose caps, then using the standard difference-in-differences (DID) regression model to estimate the impacts of caps on premiums might produce invalid estimates.[9] Third, none of the studies reports results from tests of all assumptions required by the empirical models. Every empirical model, even the simplest of models, might produce invalid results if just one of a number of assumptions fails.[10] A detailed review of the literature makes clear that not much, if any, weight can be placed on any one of the existing empirical studies that estimates the impacts of caps on premiums.

Whether and how caps impact premiums is important for a number of reasons. First, proponents of caps justify the intervention by claiming that physicians will enjoy lower prices for medical malpractice insurance and that, in turn, consumers will pay less for health care.[11] Predicted impacts of caps, however, are not straightforward. If physicians believe that caps reduce the likelihood of malpractice claims, they might be more willing to forego costly but customary (and therefore non-negligent) care, at least on the margin, which might lead to higher claim rates and higher medical malpractice insurance premiums.[12] Thus, determining the impacts of caps can help us understand their

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[9] [cite econometrics text]

[10] [include list of assumptions required by OLS as an example and point to source]

[11] Proponents of caps also argue that limits on tort recoveries will reduce the amount of defensive medicine practiced by doctors and decrease the cost of medical care. [cite] Defensive medicine is commonly defined as diagnostic or treatment procedures recommended by physicians not because they are in the best interests of the patient but because they reduce the physicians' liability exposure. [cite] Although the empirical evidence is mixed, recent studies employing strong methods conclude that tort reform did not impact physician treatment choices or that any reduction in defensive medicine resulting from tort reform would be small relative to total medical costs. See e.g., Waxman et al. (2014) ("Legislation that substantially changed the malpractice standard for emergency physicians in three states had little effect on the intensity of practice, as measured by imaging rates, average charges, or hospital admission rates."); Frakes (2012) ("Contrary to the conventional wisdom, I find no evidence to support the claim that malpractice pressure induces physicians to perform a substantially greater number of cesarean sections."); Sloan and Shadle (2008) ("The overall conclusion is that tort reforms do not significantly affect medical decisions, nor do they have a systematic effect on patient outcomes."). These results, however, should be taken with a grain of salt given the difficulties in measuring defensive medicine and the narrow scope of the studies with respect to physician practice areas. Much more evidence is required before we will be able to draw general and confident conclusions about how tort reform impacts defensive medicine.

[12] This, of course, assumes that legally customary care produces the highest net benefits to society. Given that, by definition, the legal standard is set by customary practice and health care markets are plagued by asymmetric information, this assumption is questionable.

social welfare effects. Second, if caps do not achieve their intended goal, they could result in a net decrease in social welfare given potential negative impacts. For example, some have produced evidence suggesting that caps might have disproportionate impacts on particularly vulnerable subgroups of the population.[13] If we don't enjoy benefits from caps, and some of us suffer a cost in the form of the inability to recover fully for losses related to medical malpractice or to find a plaintiff's lawyer who is willing to pursue the claim, caps might negatively impact social welfare Third, Congress continues to consider whether to impose a federal cap on damages recoverable through tort suits against physicians (House bill H.R. 5 (March 22, 2012)). Before implementing caps widely, we should have a solid understanding of their impacts

The purpose of this study is to produce more reliable estimates, relative to existing studies, of the impact of statutory damages caps on medical malpractice insurance premiums. First, the study employs a new, hand-assembled dataset of premiums covering a number of years, a number of medical malpractice insurers, a broad range of states, various specialties, and a wide array of coverage characteristics including a number of different per occurrence and aggregate policy limit pairs. Second, the study aims to improve on the methods employed in previous studies. For example, the present study uses techniques to control for potential simultaneity, which likely is present given that states regularly reform the tort system in a number of ways, including implementing caps, when premiums start to trend upwards. Additionally, this potential caps-trigger suggests that trends in premiums differ in states that have passed caps ("treatment states") relative to states that have not ("control states"). Econometric models typically used to estimate the impact of caps on premiums assume that trends in premiums prior to the imposition of caps in treatment states are similar to trends in control states.[14] We not only test this assumption, but we also use techniques to account for the lack of parallel pre-treatment (i.e., pre-cap) trends.

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[13] See e.g., Rubin and Shepherd (2008) ("[insert quote from paper]" (p. xx)); Hyman et al. (2009) ("The non-econ cap has a disparate impact across plaintiff demographic groups, with larger percentage reductions borne by deceased, unemployed, and (likely) elderly plaintiffs, relative to non-deceased, employed, and non- elderly plaintiffs." (p. 358)) [*check methods*]

[14] See *infra* Part IV for a discussion of empirical methods employed in this study.

[insert summary of results here]

The paper proceeds as follows. Part I discusses the theoretical impacts of caps on the price of medical malpractice insurance. Part II summarizes the existing empirical literature and describes weaknesses of the data and methods used to produce estimates. Part III describes the data employed to test the theoretical predictions. Part IV summaries the empirical models used to produce estimates. Part V presents estimates of the impact of caps on premiums. Part VI concludes.

I. Theoretical Impacts of Caps on Insurance Premiums[15]

Theoretical predictions regarding the impacts of caps on premiums vary depending on the theories' assumptions and scope. The most basic theories predict that caps will reduce average court awards and settlements in medical malpractice cases, which will lead to a reduction in the claim rate.[16] Reductions in both average awards and claim rates are predicted to decrease medical malpractice insurance prices.[17] Others predict that tort reform, including damages caps, stabilizes the liability environment, which leads to less underwriting uncertainty and lower premiums.[18]

Broader accounts consider additional elements of the litigation process that might influence how caps impact premiums. For example, Zeiler et al. (2007) report evidence suggesting that medical malpractice policy limits act as de facto caps on tort recoveries.[19]

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[15] [add details behind theories; any other theories in literature?]

[16] Evidence suggests that caps decrease amounts paid to close malpractice claims (e.g., Yoon, 2001), but studies estimating the impacts of caps on claim rates find no evidence of decreased claim rates (e.g., Donohue and Ho, 2007).

[17] See e.g., Rubin, 1993; U.S. Congress, Congressional Budget Office, 2011.

[18] See e.g., Born and Viscusi, 1998; Barker, 1992.

[19] Zeiler et al. (2007) find that plaintiffs almost never recover amounts in excess of the per occurrence medical malpractice policy limit, even in cases where the court awards a judgment in excess of the limits. The study analyzes 9,525 insured closed medical malpractice claims, including claims settled before trial, that were closed with a payment over $25,000 (in 1988 dollars) in Texas from 1990-2003.

Rarely do plaintiffs settle for amounts that exceed the physician's per-occurrence coverage limit. This phenomenon seems not to be the result of physicians' acumen in choosing policies with limits sufficient to cover all potential claims. The study finds that the percentage of claims that close at or very near the coverage limit statistically significantly increases as the coverage limit shrinks.[20] These findings imply that, at least under certain circumstances, statutory damages caps might not have a chance to do much work to reduce average payouts and claim rates. If the average payment is not impacted much by statutory caps because policy limit "caps" bind first, then claim rates and average awards likely will not decrease when a statutory cap is imposed. It follows that we should not expect premiums to adjust much, if at all.

Others consider the impact of caps on plaintiff attorney choices related to how to present damages claims. For example, Sharkey (2005) posits two behavioral reactions by juries that might prevent caps from working to reduce awards. She first points to findings from the experimental economics literature related to anchoring to posit that juries might anchor on the cap and adjust damages downward. This anchoring effect, the argument goes, might result in higher non-economic damages relative to the pre-cap regime (Sharkey, 2005, pp. 422-428). Alternatively, Sharkey posits that non-economic damages caps might have "cross-over effects" in the sense that a cap on non-economic damages might encourage plaintiffs' attorneys to more aggressively pursue economic damages relative to regime with no damages caps. Under this conjecture, Sharkey predicts that, in states with caps, lawyers will convince juries to award higher economic damages. Thus, the predicted effect on total damages is ambiguous—it depends on how much wiggle room the plaintiffs' lawyers have on the economic damages front.

Still others have looked beyond the litigation realm to consider how caps might impact physician treatment choices and how changes to treatment choices might affect injury rates and claim rates. In a game-theoretic model, Zeiler (2003) analyzes

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[20] For example, while only 3.5% of claims against physicians with real coverage limits of greater than $1 million closed at or near the policy limit, 35% closed at or near the limit when real limits were less than $250,000 (Zeiler et al., 2007, p. S23). Payments rarely exceed the limit. In just 1.5% of all paid claims were payments in excess of the policy limit (0.6% of claims against policies with limits in excess of $1 million and 3.7% of claims against policies with limits at or below $250,000). Insurers made the vast majority of these payments despite the contractual coverage limitation.

physicians' reactions to reduced exposure to liability that results when states impose damages caps. When health care payers (e.g., health care insurers) compensate physicians using methods to discourage unnecessary medical procedures, and physicians know more than patients about what sorts of care are necessary, then caps might compel physicians to lean towards failing to providing costly but necessary (and legally compliant) medical care, at least on the margin. This behavioral reaction might increase the number of patient injuries, increase litigation rates and increase the number of payments. So, even if caps effectively reduce the average payment, a countervailing increase in the number of claims might result in no change in premiums or an increase (or decrease) in premiums. Predicted changes in premiums will depend on the relative impacts of these two competing forces. [21]

The disparity in predictions of various theories and political promises motivates empirical investigation of the impacts of caps on premiums. If we find that caps do not work to quell the increase in premiums, then we must consider reforms that might more effectively reduce the cost of medical care, assuming this maximizing total social welfare given potential negative impacts on individual litigants. Problems with the existing empirical literature, discussed next, give rise to the need for further work.

II. Existing Empirical Literature

Medical malpractice insurance price fluctuations have received a great deal of attention during the last four decades. The U.S. has endured three distinct periods of sharp increases in premiums—once during the mid-70s, again during the mid-80s and most recently during the early-00s. Labeled as "medical malpractice insurance crises," these periods are characterized by a reduction in the number of insurance suppliers, steep increases in prices, especially for policies covering specialties such as obstetrics, and intense lobbying by health care providers for tort reform. State legislatures have responded by enacting a variety of reforms aimed in part at reducing the price of medical

[21] Arlen and MacLeod (2005) develop a model that makes similar predictions, although they assume that caps will influence physician choices over how much to invest in the development of expertise, which will impact the number of patient injuries caused by legally non-compliant care.

malpractice insurance.[22] Given the variation of implementation of different reforms across different years in various states, empiricists have been able to estimate the impacts of various tort reforms on premiums and other outcomes of interest.

Debates about the impacts of caps on medical malpractice insurance premiums are often muddled by the mixed empirical results. Proponents of caps point to empirical studies supporting the claim that caps reduce premiums, and opponents point to studies supporting the opposite claim.[23] The conventional wisdom among researchers seems to be that caps work to reduce premiums.[24] Most every existing study, however, reports mixed results—some regression results support the claim that caps put downward pressure on premiums, but other regression results do not allow us to reject the claim that caps have no impact.[25]

When empirical results are mixed, as a first step we attempt to identify which studies employ best methods and the cleanest and most comprehensive datasets. We can then assess how much weight to place on each study (and the results within each study) when drawing conclusions from the body of evidence. To evaluate methods, we might begin by considering the ideal experiment. In our context, ideally we would conduct a randomized controlled trial by randomly assigning half the states (or insurance companies or physicians) to a treatment group and the other half to a control group. We would impose caps in all units of the treatment group in period 1. In period 2 we would measure the average difference in premiums between period 1 and period 2 in the control group, the average difference in premiums between period 1 and period 2 in the treatment group, and then measure the difference in those differences, which would represent the average marginal effect of damages caps on premiums.

Randomized controlled trials are, of course, not perfect. Random assignment might not produce treatment and control groups with similar characteristics. For example, with some likelihood, states assigned to the treatment group will be characterized by increasing trends in pro-defendant courts. In this case, we might mistakenly attribute the

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[22] [RA to search state legislative histories for stated purposes behind caps]

[23] [insert citations]

[24] See e.g., Paik et al. (2014, p. 3); Mello and Kachalia (2010).

[25] See Section XX, *infra* for summary of the existing empirical literature.

difference in differences in premiums to caps when it should be attributed to variation in court favoritism, which, unluckily, is correlated with the random imposition of caps. If the number of states in each group is sufficiently large, however, the likelihood of ending up with similar distributions of potential confounds is high. Generally, if sample sizes are sufficiently large, the distributions of both observable and unobservable characteristics of members of the treatment and control groups should be similar. This implies that we can attribute any difference in average premiums to the cap.

Unfortunately, conducting randomized controlled trials in this context is impossible for obvious reasons. We, therefore, are left to estimate treatment effects using econometric techniques designed to control for selection effects and confounds (Zeiler and Hardcastle, 2013). The existing empirical literature employs a number of such techniques including difference-in-difference (DID) estimation, controls for delayed response to caps and anticipation of caps, and controls for confounds including other types of tort reforms passed at the same time as caps and differences in potential claimant demographics, exposure to health care services, insurance market characteristics, and attorney market characteristics, the distributions of which might differ across the treatment and control groups given non-random assignment of caps.

Drawing inferences from the existing body of evidence is difficult. First, as noted previously, the results vary widely. To date, researchers have published 16 studies that report a total of 197 estimates of the impacts of caps on premiums derived from regression analyses. Of the total number of estimates reported, 136 estimates (69%) are not statistically significantly different from zero at the 10% significance level, 12 (6%) are statistically significant and negative at the 10% level (but not the 5% level), and 49 (25%) are statistically significant and negative at the 5% level (Zeiler and Hardcastle, 2013).

Second, the researchers have employed a variety of empirical models but none of the studies reports the results from tests of the models' assumptions (Zeiler and Hardcastle, 2013). For example, an identifying assumption of DID models is parallel pre-treatment trends. If trends in premiums leading up to the imposition of caps in treatment states are different across treatment and control states, then the control states are not valid controls in the sense that we can't assume that post-treatment trends in the control states

are valid counterfactuals for use in estimating the treatment effect of caps (Angrist and Pischke, 2009). This implies that we cannot draw causal inferences from the results. None of the existing studies that employ DID models reports estimates of pre-treatment trends. The same is true for other assumptions that must be satisfied for the models to produce valid estimates.

Third, the data employed to measure insurance premiums is problematic. Researchers have used different data sources to measure the price of insurance including (1) the National Association of Insurance Commissioners' (NAIC) data on aggregate annual premiums written or earned,[26] (2) the NAIC's data on loss ratios, the ratio of annual earned premiums to annual incurred losses (a proxy for the average amount paid by providers per indemnified dollar), and (3) the Medical Liability Monitor's (MLM) company-level survey data collected from insurers on amounts paid by providers for policies of a single type (e.g., mature claims-made policies[27] with limits of $1 million per occurrence and $3 million annual aggregate) in each state for internal medicine, general surgery and obstetrics/gynecology only (Zeiler and Hardcastle, 2013). The MLM, which started to collect data in 1991, reports premiums by county for some states; most reports, however, are average premiums of the reporting insurers by state and by insurer.

Each one of these data sources comes with substantial drawbacks. Aggregate premiums represent revenue, which is a product of both quantity sold and price. Thus, untangling changes in quantity sold from changes in price is impossible. In addition, as

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[26] "Premium written" is the total premium the insurer has charged (or will charge) for a group of policies. "Premiums earned" is the total premium recognized as revenue for the accounting period in question. Premiums for liability insurance policies generally are recognized as revenue over time as the risk covered by the policy expires over the life of the policy.

[27] Mature policies are those sold to providers who have purchased claims-made insurance policies from the insurer for at least some number of years (usually five). Prices for providers who are relatively new to the insurer are lower because claims-made policies cover only claims filed during the coverage period for injuries caused by events that occurred in *some period during which the insurer covered the physician*. For example, when a physician buys her first claims-made policy from an insurer, the insurer will cover only claims that result from injuries inflicted during that coverage period and that are filed during that coverage period. Insurers offer an additional policy called extended tail coverage to cover claims arising from events that occurred in some period not covered by the insurer. Occurrence policies, by contrast, cover all claims that that are filed during the coverage period regardless of when the injurious event occurred. The recent trend has been away from occurrence policies and toward claims-made policies because they are easier to price.

Born and Viscusi (1998) have pointed out, this measure does not account for differences in policy characteristics for the group of policies sold in a particular legal environment. In the absence of information about policy characteristics such as policy limits, controlling for changes in these characteristics is impossible. As an example, we might expect that at least some physicians will chose to buy policies with lower coverage limits when damages caps are imposed (e.g., implementation of a cap of $250,000 on non-economic damages might compel at least some providers to switch from a policy that covers $1 million per occurrence to a policy that covers $500,000 per occurrence). If we were interested in estimating the impact of damages caps on premiums, the use of aggregate premiums data would not allow us to separate the impact of caps from the impact of changes in physician choices over policies with different limits. While aggregate premiums data are a good proxy for business growth, they might not be a good proxy for price. Researchers who employ loss ratios as a proxy for price face similar limitations—separating the impact of changes in the mix of policy types sold from the implementation of tort reform (or other changes to the legal environment for that matter) is impossible. Loss ratios are better used as a proxy for profitability. If profitability does not correlate strongly with premiums, however, then using profitability as a proxy for premiums will introduce measurement noise, which might bias the estimates.

The MLM dataset alleviates some of the limitations described above. Several downsides remain, however. First, the MLM generates the data using voluntary reports by insurers, which potentially leads to selection bias—insurers who have substantially raised premiums might not want to report for fear of sending negative signals, for example, about potential solvency problems.[28] Second, the MLM collects prices on policies with just one type of coverage sold in each state. Average prices for policies with a $1 million per occurrence limit and a $3 million annual aggregate limit are reported for most states, likely because these policies are perceived as being the most common type sold. Recent evidence suggests this might not be the case, though.[29] Thus, the MLM data

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[28] *Note to workshop readers: Once the premiums dataset is complete, we can estimate the level of selection bias present in the MLM dataset. We can report it here, or it might be worth a separate paper. Comments welcome.*

[29] Zeiler et al. (2007) reports that only 31% of policies purchased between 1988-1999 by Texas providers that faced medical malpractice claims had per occurrence policies with limits of $1

on the price of policies with $1 million per occurrence limits present only part of the picture. If prices of different policy types are impacted by the movement of providers from one policy type to another following tort reform and the market is impacted by adverse selection (i.e., riskier providers select into bigger policies), then prices are likely impacted not only by tort reform but also by changes in estimated average losses given the estimated characteristics of providers selecting into each policy type. For these reasons, the most useful premiums dataset includes prices for different policy types. Third, tort reform impacts different types of providers in different ways. For example, medical malpractice insurers are known for working with anesthesiologists to reduce the risk of injury to patients. Thus, we might expect less of an impact of tort reform on these providers. If data were available on this provider type, it could be employed in the implementation of different methodological techniques that attempt to control for unobservable variables (e.g., triple difference methods). Thus, it would be useful to have data on a wide variety of provider types in addition to internal medicine, general surgery and OB/GYN.

The present study attempts to improve upon the existing studies by employing a unique, hand-coded dataset of premiums collected from state department of insurance rate filings, which every state requires insurers to file.[30]

III. Data

The analysis employs data on prices offered by insurers with substantial market share in all 50 states from 2001-2011, state statutory tort reforms and a wide variety of control variables.

Premiums. Data on the outcome variable of interest, medical malpractice insurance premiums, are collected from state departments of insurance. All states require insurers to report insurance policy prices they plan to offer (or are offering) to physicians

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million. Six percent had limits of more than $1 million, 32% had limits of $200,000 or less, and the distribution of policy limit amounts changed fairly substantially over time (the five most common per occurrence limits were $100,000, $200,000, $500,000, $1 million and $2 million).

[30] [add summary of state rules regarding risk retention group filing requirements]

practicing in particular territories of the state and in different medical specialties. Insurance premiums differ by physician practice specialty (e.g., OBGYN v. cardiology v. family practice), the amount of insurance coverage (specified by per occurrence and annual aggregate limits), and the number of years of risk exposure insured (e.g., physicians who have been with the same insurer for five years or more purchase "mature" policies, which are more expensive than policies sold to physicians who have purchased from the company for fewer years), and whether the policy is an occurrence policy or claims-made policy. The dataset includes prices by insurer, by state territory, by physician specialty, by coverage limits, and by month for occurrence and mature claims-made policies.[31] We included all offered policies with one-year coverage periods.[32]

Our goal was to obtain premiums for all policies offered to individual physicians[33] by the set of companies with the highest market shares and comprising at least 70% of the total market share during each state/year. We first collected all relevant filings housed in a database constructed by an insurance consulting firm, Perr&Knight (P&K).[34] P&K's database contains over 2 million original property and casualty insurer rate, rule and form filings.[35] The database includes XX relevant filings covering XXXX-YYYY across all 50

[31] Thomas et al. (2010) assembled a similar dataset. Premiums data were collected from state insurance department rate filings. They collected data on premiums for policies with $1 million/$3 million coverage only. The dataset includes premiums for four physician specialties: internal medicine, general surgery OB/GYN and urology. The dataset covers premiums charged annually from 2004-2006. To our knowledge, it is not available publically. Attempts to obtain the data from the authors failed.

[32] The vast majority of policies offered cover one year.

[33] Our premiums data does not cover physicians who are covered by group policies or by hospitals. Thus, our conclusions will be limited to the impact of caps on premiums for individual physician policies.

[34] http://www.perrknight.com/about-us/.

[35] Rate filings include insurance policy prices, rule filings contain details on discounts and endorsements offered by the insurer, and form filings contain the forms used to inform insurance consumers about policy terms and to collect information from consumers that insurers use to determine the overall price of each policy.

states and the District of Columbia.[36] All prices for policies reported in these filings were coded by hand.[37]

The P&K database is comprehensive, but it does not include filings for all insurers with significant market share in every state/year. Using market share reports compiled by the NAIC, we determined the set of filings for all relevant insurers with more than 5% market share in any year 2001-2011 that were not included in the P&K dataset.[38] P&K assisted in obtaining these missing filings directly from state departments of insurance.[39] We focus on the period from 2001-2011 because NAIC market share reports allow us to check the completeness of the P&K dataset for this set of years.[40]

Damages Caps. Data related to tort reforms is taken from Avraham (2014, 5th ed.), a coded dataset that includes caps on non-economic damages, caps on punitive damages, and caps on total damages. The dataset includes details about effective dates, the outcomes of legal challenges and amendments. The dataset also includes information about the amounts of the caps and whether the caps are tied to inflation or some other inflator. In some cases, caps apply to some types of policies but not others, or they apply differently across different policy types. For example, Florida's 2003 cap on non-economic damages related to medical liability claims is generally $500,000, but a $150,000 limit is imposed on claims against emergency room practitioners.[41] Similarly, West Virginia's 2003 cap on non-economic damages applies only to physicians carrying

[36] [coding is currently in progress; at last count we have prices for 1.7 million different policy offers]

[37] To check coding accuracy, research assistants instituted an audit procedure to verify the coding of all filings that contain relevant information. The authors checked the coding of ten percent of these filings (selected randomly). [report findings from audit]

[38] We obtained market share reports related to medical malpractice insurance markets from the National Association of Insurance Commissioners.

[39] [currently in the process of compiling the list of missing filings]

[40] The NAIC market share reports go back through at least 1976, but these early reports are organized by insurer group rather than company, which makes it difficult for us to identify missing filings. In future work, we plan to expand the analysis to years prior to 2001.

[41] West's F.S.A. § 766.118. Our premiums dataset allows us to distinguish offers made to different physician types.

insurance with at least $1 million per occurrence coverage.[42] Table 1 summarizes the status of non-economic damages caps during our period of study.

Controls. A number of controls are included to separate out the impact of variables that might be correlated with the passage of damages caps.[43] First, we employ controls for additional tort reforms because tort reforms are often passed as packages of several reforms. Avraham's dataset includes data on split recovery reforms, collateral

Table 1: Summary of Non-Economic Damages Caps 2001-2011[44]

Variation 2001-2011 (years cap in place)	No cap during period	Cap during entire period
FL (2003-) GA (2005-2010) IL (2005-2010) MS (2003-) NC (2011-) NV (2002-) OH (2003-) OK (2004-) SC (2005-) TN (2011-) TX (2003-)	AL, AZ, AR, CT, DE, DC, IN, IA, KY, LA, MN, NE, NH, NJ, NM, NY, PA, RI, VT, VA, WA, WY	AK, CA, CO, HI, ID, KS, MA, MD, ME, MI, MO, MT, ND, OR, SD, UT, WI, WV

source reform, punitive evidence reform, periodic payments reform, contingency fee reform, joint and several liability reform, and patient compensation fund reform. We supplement these with data on ad damnum reforms, expert witness rules, statutes of limitation and repose, alternative dispute resolution reforms, pre-trial settlement reforms,

[42] W. Va. Code § 55-7B-8. The dataset allows us to distinguish offers with different per occurrence and annual aggregate coverage limits.

[43] Each previously published study used some combination of the proposed controls. Sources to be determined from those studies.

[44] Source: Avraham's (2014) Database of State Law Tort Reforms (5th edition).

limitations on attorney fees, prohibitions on punitive damages insurance coverage, and patient compensation funds.[45]

Second, we include a set of controls for potential claimant demographics including urbanization levels (to control for changes in litigiousness), income per capita (to control for expected economic damages) and citizen ideology (to control for changes in citizen preferences over policy choices). Third, we control for variation in exposure to health care services using number of surgeries per capita and number of physicians per capita (to control for likelihood of injuries due to malpractice). Fourth, we control for insurance market characteristics using market concentration (to control for variation in market power of insurers), insurer organizational form composition (to control for variation in insurer profit motives), intensity of insurance price regulations (to control for variation in state price controls), whether the state runs a joint underwriting association (to control for whether high risk physicians have alternative supplier) and rates of return on investments (to control for changes in returns on insurer investments). Finally, we control for variations in the attorney market using number of attorneys per capita (to control for likelihood that an injured patient can find an attorney willing to pursue a claim). Table 2 provides the means and standard deviations for key variables.

Medical malpractice insurance policies vary along a number of dimensions in addition to price. We include controls for policy limits (a combination of per occurrence

[45] For statutes of limitation and repose (rules about how much time claimants have to file a claim post-discovery or post-injury), attorney fees (limitations on plaintiff attorney contingency fees), and pretrial screening panels (rules requiring an advisory panel to determine whether the complaint has merit), data were compiled using the National Conference of State Legislatures (NCSL), Medical Liability/Medical Malpractice Laws, Aug. 11, 2011, available at http://www.ncsl.org/research/financial-services-and-commerce/medical-liability-medical-malpractice-laws.aspx. For expert witness reforms (rules regarding eligibility of experts), we used data reported in Frakes (2013, Appendix A) and the NCSL database. For ad damnum clause reforms (rules that prohibit plaintiff to include a dollar amount sought in the complaint) we used data reported in Nancy K. Bannon, AMA Tort Reform Compendium (1989). For punitive damage insurance reform (rules that prohibit liability insurance coverage of punitive damages awards), we utilized a combination of 16 A.L.R.4th 11 (liability insurance coverage as extending to liability for punitive or exemplary damages), Punitive Damages State-by-State Guide § 4:6 (2012 ed.), and privately created databases https://www.travelers.com/business-insurance/specialized-industries/excess-casualty/docs/punitivedamages.pdf and http://www.mcandl.com/puni_states.html. We checked all cases and statutes on Westlaw for accuracy and legislative/judicial changes.

and annual aggregate limits[46]), physician specialty, insurer type (e.g., physician-owned mutual company, stock company, etc.), territory type (urban or rural) and coverage type (claims-made or occurrence[47]).

Table 2—Means and Standard Deviations of Key Variables

	Mean (Standard Deviation)
Annual Premium (all mature policies) (n = X)	
Annual Premium for Mature Policies with $1M/$3M limits (n = X)	
Annual Premium for Mature Policies with $500K/$1M limits (n = X)	
Annual Premium for OBGYN Mature Policies with $1M/$3M limits (n = X)	
Annual Premium for OBGYN Mature Policies with $500K/$1M limits (n = X)	
Non-Economic Damages Cap	
Punitive Damages Cap	
Total Damages Cap	
Split recovery reforms	
Collateral source reform	
Punitive evidence reform	
Periodic payment reform	
Contingency fee reform	
Joint and several liability reform	
Patient compensation fund reform	
Ad damnum reforms	
Expert witness rules	
Statutes of limitation and repose	
Alternative dispute resolution reforms	
Pre-trial settlement reforms	
Limitations on attorney fees	
Prohibitions on punitive damages insurance coverage	
(additional controls)	

[46] Insurers offer policies that come with a wide variety of coverage limits. We will use the set of coverage limits that are most commonly offered. [**need to determine most common set**]

[47] Claims-made policies cover claims made by the policyholder during the coverage year. Occurrence policies cover claims for harm stemming from services rendered during the coverage year, no matter when the claims arise.

IV. Empirical Methodology

To estimate the average impact of damages caps on medical malpractice insurance premiums across all policy types, we estimate the following standard difference-in-difference (DID) model:

$$\ln(Premium_{i,s,t}) = \alpha + \beta_1 NECap_{i,s,t} + \beta_2 \boldsymbol{TortReforms}_{s,t} + \beta_3 \boldsymbol{Demo}_{s,t} + \beta_4 \boldsymbol{Expos}_{s,t} + \beta_5 \boldsymbol{Ins}_{s,t} + \beta_6 \boldsymbol{Atty}_{s,t} + \beta_7 \boldsymbol{Policy}_{i,s,t} + \gamma_s + \lambda_t + \eta_{s,t} + \varepsilon_{i,s,t}$$

where $\ln(Premium_{i,s,t})$ represents the natural log of premiums (in 2011 dollars[48]) for policies offered to individual physicians in state s = {0, …, S[49]} in month t = {0,…,132} for individual policy offer i.[50] α represents the intercept. The treatment indicator $NECap_{i,s,t}$ is coded as 1 if a cap on non-economic damages was in place in the state/month and applied to the offered policy, and 0 otherwise.[51] β_1 identifies the average marginal impact of non-economic damages caps on premiums. $\mathbf{TortReforms}_{s,t}$ represents a set controls for additional tort reforms, $\mathbf{Demo}_{s,t}$ represents controls for potential claimant demographics, $\mathbf{Expos}_{s,t}$ represents controls for levels of exposure to medical care, $\mathbf{Ins}_{s,t}$ represents controls for insurance market characteristics, $\mathbf{Atty}_{s,t}$ represents controls for attorney market characteristics, and $\mathbf{Policy}_{i,s,t}$ represents controls for policy characteristics. State fixed effects, γ_s, and month fixed effects, λ_t, control for fixed differences across states and across months, respectively. State-specific linear time trends

[48] Premiums are adjusted using the Consumer Price Index.

[49] S, the total number of states and territories in the U.S. included in the study, to be determined. We might not have sufficient data for all states. Also, we might have sufficient data to separate premiums by regions within large states, where insurers offer different prices in urban and rural regions within the same state.

[50] Premiums naturally are non-negative. This often results in a violation of the ordinary least squares (OLS) model assumption that residuals are normally distributed. Log transforming the dependent variable often results in normality, but not always. [report tests of normality of residuals]

[51] We use effective date and not the date of enactment. If the reform was effective for less than half the month, we code as not in effect that month. We use the same method to code months during which the legislature repealed the reform or the judiciary overturned it. We plan to employ methods similar to Yoon 2001 to determine the impacts of repeals and overturns.

are captured by $\eta_{s,t}$, which allow all states to follow different linear trends. The error term is captured by $\varepsilon_{i,s,t.}$[52]

The key assumption of the DID approach is that the imposition of caps is exogenous. That is, the model assumes that caps are not correlated with unobserved factors that affect premiums. Including basic controls and state and month fixed effects enhances the credibility of this assumption. This assumption also implies that, in the absence of the imposition of caps, the trends in premiums in treatment states would have remained the same as those experienced by the control states.

Exogeneity is violated if states adopt caps for reasons that are unobserved, and those reasons independently impact premiums. Assume, for example, that premiums are cyclical in nature and that state legislatures implement caps only if premiums exceed a certain threshold. Premiums might decrease after a cap is implemented, but only because they hit a peak in their natural cycle and not because caps drove them lower. In this case, researcher attribution of premium reductions to caps would be invalid.

[We will check this assumption. If we find that pre-treatment trends in premiums are non-parallel, we will consider a number of methods (e.g., identify states in the same region of the U.S. that are similar in important ways except for the implementation and subsequent judicial nullification of a damages cap during the period in one of the state (see Yoon 2001, which used this technique to estimate the impact of caps on settlement amounts); employ covariance-adjusted randomization inference (see Donohue and Ho 2007[53], which uses this technique to "reduc[e] the role of unwarranted distributional assumptions, incorporate[e] more information about treatment assignment, and reduc[e] model dependence"—they also explore the conventional estimator assumption of independent state-month cap adoption, which is likely violated given the stickiness of caps from month to month); test for differential trends in the pre-implementation period through the estimation of specifications that include a single pre-period lead indicator (or

[52] Standard errors are clustered at the state level to allow for arbitrary within-state correlations of the error structure (Bertrand, Duflo and Mullainathan, 2004). [cluster at insurer level as robustness check] [check for outliers]

[53] Following Ho & Imai 2006; Greevy et al. 2004; Rosenbaum 2002; and Fisher 1935. This model might be preferred to other methods including propensity score matching, model averaging, robust regression and bounds analysis given that the method requires no specification of the error correlation structure.

dynamic specifications that include several pre-period leads) (see Frakes 2013[54]; Frakes also uses a randomized inference approach, a systematic one-by-one dropping of treatment states and the inclusion of additional covariates as robustness checks).]

Cap Types: We plan to run similar models to estimate the average treatment effect of caps on punitive damages and caps on total damages.

Sensitivity Tests: We plan to run a number of sensitivity tests. For example, we plan to
(1) Use leads and lags to determine whether the impacts of caps are anticipated or whether insurers delay their reaction to caps because, for example, a constitutional challenge is predicted,[55]
(2) Use alternative variables for caps to determine whether the nature of the caps change the results (e.g., states pass caps with different limits on damages awards; some caps are tied to inflation and some are not),
(3) Use subsets of the data to address the assumption that premiums by state/month/policy are conditionally independent. This might not be true if, for example, physicians of a certain risk type decide to reduce their coverage. We can use subsets of observations to analyze whether physicians of different risk profiles decide to stick with coverage amounts after states implement caps or switch to lower coverage amounts. We might also be able to pick up these effects using interaction terms.

Tests of Sub-group Predictions: Caps might impact different policy types in different ways. For example, some have reported evidence suggesting that caps impact different types of potential plaintiffs differently. For example, injured patients who do not suffer substantial economic losses might face difficulties in finding an attorney willing to pursue a claim given the large costs couple with the recovery limit. We hypothesize that physicians who specialize in geriatrics or obstetrics might experience larger reductions in

[54] Following Acemoglu and Finkelstein (2008) and Gruber and Hunderman (2008).

[55] Grace and Leverty (2013) find that insurers rationally react to reforms that are eventually overturned by the court by not adjusting premiums downward.

exposure to liability when states impose caps on non-economic damages relative to physicians practicing other specialties.[56]

In addition, caps might impact the prices of policies with different coverage limits differently. Two types of effects are possible. First, policies with limits below the damages cap might not experience a change in price given the fact that the cap is not predicted to change expected losses for those policies. On the other hand, we expect that prices for policies with substantial limits will decrease when caps are imposed because the caps will be binding on awards and settlements covered by these more generous policies. Second, prices might react to changes in the composition of physicians selecting policies with different limits when caps are imposed. Physicians who once selected generous policies might be willing to purchase less generous policies, while other physicians might keep their generous policies. If selection is based on predicted exposure to liability, then insurers might decrease the prices of their less generous policies and increase the prices of their more generous policies due to the adverse selection. Because we have data on policies with a wide range of coverage limits, we can test theories related to these sorts of selection effects.

Within-state variation in damages caps rule or their predicted impacts will allow us to employ difference-in-difference-in-difference models to estimate potentially differential impacts of caps on the prices of policies sold to different specialties and on the prices of policies with different policy limits. While we might expect caps to impact OBGYN premiums, for example, we might suspect less of an impact on anesthesiologist premiums given the work medical malpractice insurers have done in the past to reduce injury rates and severity caused by anesthesiologists. In addition, caps in some states impact different types of policies or different types of doctors differently. For example, in 2003, Florida passed a cap that limits non-economic damages to $150,000 per claimant for emergency room practitioners and to $500,000 for all other physicians. Thus, we

[56] While Studdert et al (2004) do not find any difference in verdict awards by gender or by age (i.e., elderly v. non-elderly), they admittedly do not consider the impact of caps on the likelihood that a suit will be filed. They argue, however, that "[t]here is every reason to expect the "shadow" of the impacts of caps we identified to fall across settlements. Litigants' expectations about potential returns in court exert a powerful influence over settlement negotiations, establishing the parameters for both liability questions and valuations of damages." This prediction does not take into account selection effects produced by plaintiff attorneys when they select cases to pursue.

would expect to see varying average treatment effects across different doctor types. Similarly, in 2003, West Virginia amended its 1986 reform, which capped noneconomic damages at $1,000,000, to reduce the limit on noneconomic damages to $250,000 but only if the physician carries insurance that covers at least $1,000,000 per occurrence. Theory predicts that the average treatment effect on policies with per occurrence limits at or over $1,000,000 will differ from the effect on smaller policies.

V. Results

[to come]

VI. Conclusion

[to come]

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Appendix

Table A1: Medical Malpractice Premium Summary Statistics

State	No. Companies	Cum Market Share	No. Territories	ISO Code	Name	$1M/$3M in 2001	$1M/$3M in 2011	$500K/$1M in 2001	$500K/$1M in 2011
AK				80143 80145 80153 80257	General Surgery Urology – Surgery Obstetrics/Gyn Internal Medicine-NS				
AL				80143 80145 80153 80257	General Surgery Urology – Surgery Obstetrics/Gyn Internal Medicine-NS				
AR				80143 80145 80153 80257	General Surgery Urology – Surgery Obstetrics/Gyn Internal Medicine-NS				

Etc……