> *"I want to be honest with you. I'm not advocating caps on malpractice awards... (BOOING) ... which I believe -- I personally believe can be unfair to people who've been wrongfully harmed. But I do think we need to explore a range of ideas …."* [1]

> Transcript of a June 2009 speech by President Barack Obama to the American Medical Association

1. Introduction

Since Charles Tiebout's 1956 seminal paper, economists have analyzed the effect of government policies such as taxes, publicly provided goods and services, and regulatory climates on the location of economic activity. In this paper, we analyze whether physicians "vote with their feet" and migrate toward malpractice climates they deem more favorable.

Policymakers, academics, and the medical and legal professions have engaged in fierce debates over the impact of medical malpractice laws on the provision of health care services. An important point of contention is over the severity of penalties given to medical professionals who are found to have engaged in medical malpractice. Some suggest that a "severe" medical liability climate is needed to hold medical practitioners accountable for all the damages they may cause through negligence, which gives physicians the incentive to provide higher quality care. [2]

Others suggest that severe medical liability climates have the unintended consequence of increasing medical costs and reducing the supply of physicians, which could lead to a lower level of access to medical services for patients. They maintain that liability reforms would reduce

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[1] Quote obtained from transcript of June 15, 2009 speech at 158th annual meeting of the American Medical Association. http://www.washingtonpost.com/wp-dyn/content/article/2009/06/15/AR2009061501817_5.html (Accessed June 18, 2009)

[2] For example, Michael Greco, president of the American Bar Association, noted that he has "tried to emphasize the injustice of denying compensation to patients who have proven in court that they have been injured by medical malpractice" and "point out that capping malpractice awards will do nothing to make it easier for ordinary Americans to receive affordable, quality health care." (http://www.abanet.org/barserv/medmal/ , accessed June 20, 2009)

medical costs, increase access to medical care, and have no detrimental effect on quality.[3]

The trend in policy has been for states to implement medical liability reforms that reduce the severity of medical malpractice climates. For example, since 1980, twenty states have implemented a cap on non-economic damages and thirty-seven states have instituted joint and several liability reform.

This paper uses national data on a sample of individual physicians to provide evidence on the extent to which each of five medical malpractice reforms impacts the decisions of physicians to move their practice to another state. The five reforms considered are

- Cap on non-economic damages

- Joint and several liability reform

- Collateral source rule reform

- Patient compensation fund

- Mandatory periodic payment of judgments.[4]

Understanding how these medical liability reforms impact the migration decisions of physicians across states is important because of the potentially large impact of physician migration on access to medical care.

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[3] For example, the American Medical Association notes that it is "an outspoken advocate for liability reform as a means of protecting patients' access to care and slowing the rising cost of health care." (http://www.ama-assn.org/ama/pub/legislation-advocacy/current-topics-advocacy/practice-management.shtml , accessed June 20, 2009)

[4] Other important questions about medical malpractice climates include their effect on medical malpractice insurance premiums, health care costs due to providing inefficient amounts of defensive medicine, and on the quality of medical care. Helland and Showalter (forthcoming) provides a brief overview of the research on these other important questions.

To our knowledge, we are the first study to analyze the effect of malpractice climates on the supply of physicians using information from the second large wave of malpractice reforms, the decade of the 2000s.[5]

We employ a cautious empirical strategy to estimate the effect of these five reforms on the moves of physicians between states that (a) excludes young (<35 years old) physicians who are much more likely to move between states and older (>64 years old) physicians who may move for a larger number of reasons; (b) includes individual demographic variables to control for characteristics that may impact migration decisions; (c) uses two control groups of medical professionals; and (d) includes state fixed effects to control for state-level time invariant factors that impact moves between states. Essentially, we estimate the probability of a move between year t-1 and year t as a function of the malpractice climate present in the state where the physician resided in year t-1. We also report the change in the probability of living in a state with each of these five malpractice reforms for physicians who move.

Our analysis of individual physician migration decisions shows that physicians do "vote with their feet." In our preferred specification, we find that states that have implemented non-economic damage caps, joint and several liability reforms, and patient compensation funds see their physicians move away less frequently than states that do not have these reforms. These effects are both statistically and economically significant. The percentage of physicians moving in a given year is quite small on average (2.2%). We estimate that the probability of a physician moving out of a state that has implemented non-economic damage caps decreases by 0.9 percentage points. While this may seem small it translates to a 41 percent decrease in the probability that a physician moves to another state. Implementing a joint and several liability reform is estimated to reduce the probability of a move by roughly 56 percent in our preferred

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[5] The first large wave of states enacting medical malpractice reforms was in the 1980s.

specification. Having a patient compensation fund leads to about a 33 percent reduction in the

probability that a physician moves. However, in our other empirical specification only caps on

non-economic damages and patient compensation funds have a statistically significant impact on

the moves of physicians, the magnitude of each being about the same as our preferred

specification.

We also find that physicians who move states are 25 percent and 30.6 percent more likely

to live in states with caps on non-economic damages and patient compensation funds,

respectively, after their move. The increase in their likelihood of living in a state with joint and

several liability reform is only 3.6 percent. We interpret these results as providing robust

evidence that caps on non-economic damages impact the location decisions of physicians, but

more limited evidence for joint and several liability and patient compensation funds.

Our results likely understate the total effect of severe medical malpractice regimes on the

supply of physicians for at least five reasons:

- We do not model the intensive margin of the labor supply of physicians. Helland and

Showalter (forthcoming) find that medical malpractice climates impact the hours

worked by physicians.

- We do not model the initial location decisions of new physicians, and we report below

that younger physicians are more likely to move out of states that do not have four of

the five medical malpractice reforms considered in this paper.

- We do not model the effect of medical malpractice climates on the retirement decisions

of physicians. Kessler, et al. (2005) finds that more severe liability climates increase the

likelihood of physician retirements.

- Like most other studies, we do not precisely measure the medical malpractice climate in

  each state, which leads to an errors-in-variables bias of our coefficients of interest

  toward zero.

- As discussed above, our empirical approach is cautious.

The rest of this paper is organized as follows. Section II provides a review of the

literature on the effect of medical malpractice climates on the labor market decisions of

physicians. Our empirical approach is described in section III. Section IV describes the data and

results, and section V provides concluding remarks.

2. Literature Review of Studies that Estimate the Effect of Medical Malpractice Climates on the Supply of Physicians

There are lots of anecdotes about severe medical malpractice climates causing doctors to

move their practice or exit the profession (see, for example, Tibbles (2004) and Lynch (2008)).

These stories typically suggest that such legal climates lead to excessive judgments against

physicians, which provides an incentive for lawyers and patients to file frivolous lawsuits. These

supposedly excessive judgments and the increased threat of facing legal action put a physician's

personal and business assets at risk and cause medical malpractice insurance premiums to

increase. These consequences may reduce the supply of physicians and thereby reduce access to

medical care.[6]

Given that it is likely that the supply of physicians to a geographic area is impacted by

many factors, a multivariate analysis of the effect of malpractice climates on the location

decisions of physicians is warranted. In the present study, we use data on individual physicians

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[6] As stated in the introduction, more severe medical malpractice climates may increase the quality of care as physicians and other medical professional would have more incentive for quality care.

to analyze the effect of five medical malpractice reforms on the extensive margin of the supply of physicians to a state. To our knowledge, ours is the first study to use individual-level data to address this issue.

We borrow heavily from two strains of research that address the broad issue of the effect of medical malpractice climates on the supply of physicians. The empirical literature on this broad issue can be divided into two categories: (i) studies that analyze the intensive margin of the labor supply of physicians; (ii) studies that use aggregate data to analyze the extensive margin of the supply of physicians.

Next we discuss the literature in these two categories and their relevance for our study.

2.1 Intensive margin of the supply of physicians

Helland and Showalter (forthcoming) examine the impact of malpractice liability risk on hours worked by individual physicians. Using detailed and unique data on malpractice claims in Florida during the 1980s, this paper estimates state-specific expected liability costs by physician specialty. During this time period, Florida did not have any caps on non-economic damages. In their method for estimating liability risk, states with caps on economic damages and states with higher proportions of physicians in specialties with fewer and less costly medical malpractice judgments and settlements have lower estimated levels of liability risk.

Using the estimated measures of liability risk for each state they generate and two cross sections of physician level data—1983 and 1988, Helland and Showalter find a significant estimated elasticity of hours worked to liability exposure, -0.285. Thus, a 10 percent increase in liability exposure is estimated to reduce hours worked by 2.85 percent. Older physicians are estimated to have a much larger elasticity.

Helland and Showalter estimate the impact of overall liability risk on hours worked, but they do not estimate the impact of specific medical malpractice reforms. They point out that the approach to analyzing the effects of medical malpractice climates typically used in the literature—and in our study—masks some of the actual heterogeneity in these climates across states. For example, coding specific reforms as "0" (no reform) or "1" (state has the reform) masks significant heterogeneity in specific state policies. For example, some states may cap non-economic damages at $250,000, while others may have a cap of $1,000,000. In our paper and most others, the states in this hypothetical example with caps on non-economic damages would each be coded as a "1" (yes, the state has a cap on non-economic damages).

The virtue of Helland and Showalter's approach is that the actual heterogeneity between medical malpractice climates among states is not attenuated.[7] The virtue of our approach—and that of most of the literature—is that the effects of specific reforms on physician behavior can be analyzed. Nevertheless, given that state reforms are coded as "0" or "1" in our study, we have an errors-in-variables issue that biases our coefficients of interest toward zero, which indicates that the estimates reported in section IV may be underestimates of the true effects of the five reforms considered.

Dranove and Gron (2005), using hospital inpatient data from the Florida State Center for Health Statistics, compares the activity levels of obstetricians and neurosurgeons in Florida between 1997 and 2000 to the period 2000 to 2003. They find that neurosurgeons in Florida significantly reduced the number of surgeries during a time period when malpractice insurance premiums rapidly increased but did not find this effect for obstetricians. Dranove and Gron did not have access to data from other states to use as a control group.

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[7] See Helland and Showalter (forthcoming) for other examples of how the usual ways of coding medical malpractice climates mask heterogeneity in these climates across states.

2.2 Studies that use aggregate data to analyze the extensive margin of the supply of physicians

Using American Medical Association (AMA) data on the number of physicians per capita from 1980 to 1998 by state, Klick and Stratmann (2005) estimate the impact of specific medical malpractice reforms. Klick and Stratmann point out that there is a potential simultaneity issue between the number of physicians per capita in a state and medical malpractice reforms. Specifically, while less severe malpractice climates may attract physicians to a given state, a state may be more likely to pass malpractice reforms if it has a relatively larger proportion of physicians. The latter may be from a higher level of political power when physicians are relatively numerous. In addition, they note that states may adopt malpractice reforms in response to a crisis regarding a low level of access to medical care. In this latter scenario, an estimate of the effect of malpractice reforms on physicians per capita would be biased downward if malpractice reforms were treated as exogenous in an estimating equation.

To address this problem of the potential endogeneity of malpractice reforms, Klick and Stratmann use an instrumental variables (IV) approach and use percent Catholic, percent Mormon, term limits on state legislators, and the presence of class action and product liability reforms as instruments for specific medical malpractice reforms. In their IV results, they find that only caps on non-economic damages impact physicians per capita—states with caps on non-economic damages are estimated to have about 37 percent more physicians per capita than states without this reform.

Klick and Stratmann (2007) use AMA state-level data on physician populations to estimate the impact of medical malpractice liability reform on high-risk specialty physicians per capita. To identify the effect of liability reforms, they use state fixed effects and physicians in

low risk specialties as a control group. We use a similar identification strategy in this paper.[8]

Klick and Stratmann (2007) consider high-risk specialties as those that have the highest average malpractice payouts per physician while the low-risk specialties are those that have the lowest average payout. They find that only non-economic damage caps increase physician populations and that the increase is concentrated on the highest-risk specialties—physicians per capita are estimated to be over 6 percent higher for the five specialties that face the highest malpractice payouts. For the ten specialties that face the highest malpractice payouts, physicians per capita are estimated to be about 4 percent higher.

Kessler, Sage, and Becker (2005) find similar results examining the impact of medical malpractice reform on state-level data on physician populations. Following the framework of Kessler and McClellan (2005), they classify medical liability reforms into two broad categories 'direct' (reforms that directly affect how much a defendant will have to pay in the event of a judgment) and 'indirect' (limitations on whom/when a plaintiff can sue). They find that between 1985 and 2001, states that implemented 'direct' malpractice reforms had greater growth in physician populations per capita than states that did not. Kessler, Sage, and Becker use county fixed effects to endeavor to control for any endogeneity of malpractice reforms.

Echinosa and Hellinger (2005), using county-level physician data from the U.S Department of Health and Human Services' Area Resource Files from 1985-2000, find that non-economic damage caps lead to an increase in physician populations by about 2.2 percent. They also find that the effect of the caps is larger for rural counties. This paper also uses county fixed effects to endeavor to control for any endogeneity of malpractice reforms.

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[8] As discussed below in section III, we use state fixed effects and dentists and a broad category of "other health practitioners" as a control group to identify the impact of state-level medical malpractice reforms on the likelihood of individual physicians to move to another state.

While most of the literature finds evidence that medical liability reforms tend to have a positive effect on physician populations, there are exceptions. Matsa (2007), using county-level data obtained from the U.S Department of Health and Human Services' Area Resource Files from 1970 to 2000, finds that damage caps do not impact physician populations generally. However, Matsa does find evidence that caps on damages increases the supply of rural physicians. Matsa (2007) uses multiple approaches (state level fixed effects, county level fixed effects, and first-differencing—the latter is an embedded fixed effects approach) to control for any endogeneity of malpractice reforms.

Matsa and each of the other studies listed above are efforts to estimate the effects of the first large wave of malpractice reforms that occurred before 2000. We analyze the reforms that occurred during the 2000s, the second large wave of malpractice reforms.

One additional study, Baicker and Chandra (2005a,b) uses data from 1993 and 2001 to examine per capita physician levels. They find that medical malpractice costs, which they suggest are the mechanism in which medical liability reforms would operate, do not impact physician populations. However, like Matsa (2007), Baicker and Chandra find that there is some evidence that malpractice costs reduce the supply of physicians in rural counties. Their approach of using a long difference of independent and dependent variables implicitly uses state-level fixed effects to identify the effect of malpractice costs on physicians per capita. The practical effect of this identification strategy is that changes in state laws are what identify the coefficients on the variables of interest. During the time period under study used by Baicker and Chandra, 1993 to 2001, there was not a lot of change in state laws, which makes it difficult to identify the effect of malpractice climates on physician populations.[9]

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[9] For example, only five small states changed their laws regarding caps on non-economic damages during the time period studied by Baicker and Chandra (2005a,b)—Maine, Montana, Oregon, North Dakota, and South Dakota. For

2.3 Where the Present Study Fits into the Literature

We borrow from the approach of Klick and Stratmann (2007) and use state fixed effects and two control group to identify the effect of specific medical malpractice reforms on the extensive margin of the supply of physicians. We differ from Klick and Stratmann (2007) in that we use individual level data on physicians, which allow us to analyze which malpractice climates impact physician moves between states and differences in malpractice climates between sending and receiving states.

To our knowledge, we are the first study to analyze the effect of malpractice climates on the supply of physicians using information from the second large wave of malpractice reforms, the decade of the 2000s.

Finally, we view our results as complementary to the findings of the effects of liability risk on the intensive margin of the labor supply of physicians in Helland and Showalter (forthcoming). Both Helland and Showalter and the present study use nationally representative data on individual physicians.

Next, we describe our methodology.

3. Methodology

There are many reasons why a physician could choose to move (or not move) her practice to another state. One of them is in response to changes in a state's malpractice climate. In general, a physician would choose to move if the discounted lifetime net benefits of moving are

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context, it is worth mentioning that together these states have a population smaller than Virginia. In their weighted regression with first differences, it would be difficult for observations with such small weights to show effects of malpractice climates on anything. Thus, it is noteworthy that they found an effect of malpractice climates on physician populations in rural areas.

perceived to be greater than zero. If medical malpractice climates are important to a physician (whether in reality or in perception), one would see physicians voting with their feet in response to changes in the severity of malpractice climates. Specifically, physicians would be more likely to stay in or move to states that have less severe liability climates, all else equal.

A simple empirical model that estimates the impact of liability reforms on a physician's likelihood to move is:

$$(1) \quad move_{i,s,t} = \alpha + Reforms_{s,t} * \beta + X_{i.t} * \eta + \theta_t + \mu_{i,s,t}$$

where *move* is a dichotomous variable that equals "1" if the individual *i* moves from state *s* in year *t* and "0" otherwise. *Reforms* is a matrix of medical malpractice reform variables that are equal to "1" if the reform is present in state *s* in year *t* and "0" otherwise. *X* is a matrix of personal characteristics of physician *i* in year *t*. θ_t is a vector of year dummies to control for year-specific differences.

However, this strategy to estimate the impact of malpractice reforms on physician moves relies on two key assumptions. First, it relies on the assumption that there are no significant omitted variables that influence the move of physicians as a group. The second is that each element in the vector of malpractice reforms (*Reforms*) is exogenous. As discussed in the literature review, Klick and Stratmann point out (a) the possibility that a relatively large population of physicians within a given state may cause that state to adopt malpractice reforms and (b) that states may adopt malpractice reforms in response to a perceived crisis of low levels of access to medical care. If either or both of these scenarios are true, then estimates of equation (1) may be biased.

We address these issues in a manner based on the approach in Klick and Stratmann (2007)—with state fixed effects and two control groups. The state fixed effects help address this issue by capturing time invariant factors in a state that impact physicians moves. To further alleviate these concerns and to isolate the impact of the medical liability reforms more directly, a difference-in-difference estimation is proposed. If there are medical practitioners who are similar to and impacted by the currents in the state economy and medical industry as physicians but have been largely unaffected by the medical liability climate in a state, they make a strong control group. Using these other medical practitioners as a control groups provides the chance to "difference out" uncontrolled influences that might confound the estimation of the impact of medical liability reforms on physicians.

Generally, the reported primary effect of medical liability has been focused on physicians. Most other medical providers reportedly have been affected in a much more muted way, if at all. For example, according to the American Dental Association (ADA), dentists have been largely unaffected. The ADA's Council on Members Insurance and Retirement Programs noted, after looking into the recent trends of medical malpractice insurance for dentists, "the incidence and severity of dental liability claims has not been changing materially." The Council continued by stating it "has no information that would suggest these favorable conditions are likely to change in the foreseeable future." This statement is in stark contrast with the American Medical Association policy statements noting the dire effect the current medical liability crisis has had on physicians. The statement by the ADA is also of particular note given that dentists and physicians are the two practitioner groups required to have medical liability claims reported to the National Practitioner Data Bank.[10] In addition, our other control group—termed "other

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[10] The NPDB is a national database that requires all medical malpractice claims to be reported. See http://www.npdb-hipdb.com/ for more information.

medical practitioners—is largely made up of chiropractors, optometrists, and podiatrists. None

of the associations representing these groups of medical practitioners advocates for medical

malpractice reform.

To estimate the effect of medical liability reforms on physicians, we use the following

empirical model that contains state fixed effects and uses other medical practitioners as a control

group:

$$(2) \quad move_{i,s,t} = \alpha + md_i * \phi + Reforms_{s,t} * \beta + md_i * Reforms_{s,t} * \psi + X_{i.t} * \eta + \gamma_s +$$

$$\theta_t + \mu_{i,s,t}$$

where *move* is a dichotomous variable that is 1 if the individual *i* moves from her current state

and 0 if she does not. *md* is a dichotomous variable equal to 1 if individual *i* is a physician and 0

if not. *Reforms* is a matrix of medical malpractice reform variables that are equal to 1 if the

reform is enacted in the physician's state *s* in a given year and 0 if it is not. *Md * Reforms* is a

matrix populated with the interaction of *md and Reforms. X* is a matrix of personal

characteristics of physician *i*. γ_s and θ_t are state and year dummies to control for state-specific

and year-specific differences.[11]

The marginal effect of a specific reform on physicians would be the estimated coefficient

of the interaction of *md* and the specific reform (ψ). Given the state fixed effects in the model, ψ

is identified by changes in state laws regarding the five medical malpractice reforms during the

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[11] Reforms are likely to affect physician migration decisions through income changes and changes in insurance premiums, as well as a number of other avenues. The structure of our data precludes us from examining the exact structural process by which reforms affect physicians through income and premium changes, but our approach allows us to capture the ultimate effect of the reforms on move rates regardless of the avenue through which the effect occurs.

time period under study. Fortunately, states did change their medical malpractice laws between 1999 and 2005 (Table 1).

Table 1

Number of States with Each Malpractice Reform, 1999 and 2005

Reform	Number of States with Reform 1999	Number of States with Reform 2005
Cap on Non-economic Damages	17	24
Joint and Several Liability Reform	36	40
Collateral Source Rule Reform	29	33
Patient Compensation Fund	10	11
Mandatory Periodic Payment of Judgments	29	31

Source: Authors' calculations using Ronen Avraham's *Database of State Tort Law Reforms* (DSTLR, 2nd).

Physicians in states that do not have the five malpractice reforms are one control group in equation (2). Two additional control groups are used. The first is dentists, and the second additional control group is the category of medical practitioners identified by the U.S. Census as being "Health Diagnosing Occupations." This category includes dentists, chiropractors, optometrists, podiatrists, and "other" practitioners.[12] All of these practitioners are similar to physicians in level of education, that they work predominantly in office based practices, are responsible for independently diagnosing and treating medical conditions, and normally carry medical malpractice liability insurance. In the rest of the paper, we term this second additional

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[12] Veterinarians are also included in the group of health diagnosing professions but were excluded from this analysis since the animal health industry is likely quite different than the human health industry. The results were not materially influenced by this omission.

control group "other health practitioners." To be clear, the first additional control group (dentists) is a small subset of the second additional control group (other health practitioners).

While other health practitioners have not reportedly been impacted by medical malpractice climates to the extent physicians have, examining the rates each practitioner group moves relative to the medical liability reforms in a state provides evidence that the different health practitioners are impacted differently. Table 2 reports the percentage of practitioners moving based on reforms a state has or does not have. It is informative that in every case, states that do not have a specific medical liability reform have a *larger* percentage of physicians moving than states with the reform. However, some of the differences are quite small. Two differences are statistically significant: Cap on Non-economic Damages and Joint and Several Liability Reform

For the other health practitioners group, the results are quite different. Differences in rates of moving are generally much smaller in magnitude than for physicians, and the differences are never statistically significant. In fact, move rates are often a bit higher for other health practitioners who live in states with malpractice reforms. These facts strengthen the choice of these practitioners as a control group.

Table 2

Percent of Physicians and Other Medical Practitioners Moving States

Reform		Physicians		
		States Without Reform	States With Reform	Difference
Cap on Non-economic Damages		0.025	0.019	0.006*
Joint and Several Liability Reform		0.028	0.021	0.008*
Collateral Source Rule Reform		0.023	0.022	0.001
Patient Compensation Fund		0.022	0.021	0.002
Mandatory Periodic Payment of Judgments		0.023	0.022	0.001
Reform		Other Medical Practicitioners		
		States Without Reform	States With Reform	Difference
Cap on non-economic damages		0.010	0.012	-0.002
Joint and several liability reform		0.009	0.011	-0.002
Collateral source rule reform		0.013	0.011	0.002
Patient compensation fund		0.010	0.014	-0.003
Mandatory periodic payment of judgements		0.010	0.011	-0.001

Source: Authors' calculations using American Community Survey (2000-2006) and Ronen Avraham's *Database of State Tort Law Reforms* (DSTLR, 2nd).
Note - *statistically significant at 5% level.

4. Data and Results

Data for this research is drawn from two primary sources. The first is the American Community Survey (ACS), a nationwide survey conducted by the US Census Bureau each year since 2000. It is an individual-level survey with a host of demographic information. In addition, it specifically asks where the respondent lived the year before the survey. This provides the opportunity to observe individuals moving from one year to the next. The ACS provides a total

sample of physicians of about 33,000 for the 2000-2006 period. [13,14] Essentially, we have seven repeated cross sections.

Our second source of data is Ronen Avraham's *Database of State Tort Law Reforms* (DSTLR, 2nd), which provides a by-state, by-year record of the status of medical malpractice reforms, which provide the malpractice reform variables in the *Reforms* matrix. The creation of Avraham's database of medical liability laws was funded by a National Science Foundation grant with additional support from the Northwestern University Law School and was aimed at providing researchers with a single, authoritative dataset to use in research

4.1 Medical Malpractice Reforms

How the malpractice reforms enter the estimation has varied in the literature. Kessler, Sage, and Becker (2005) use an aggregated measure of reforms by incorporating two dichotomous variables: direct and indirect reforms. If a state has any of a series of "direct" reforms, such as non-economic damage caps or collateral source reform, the dichotomous variable is turned "on." This is a somewhat blunt methodology and could mask any differential impacts of individual medical malpractice reforms.

A more general method is to allow reforms to enter the model separately. Klick and Stratmann (2007) uses the most general approach and incorporates multiple reform measures as separate explanatory variables.

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[13] The Current Population Survey (CPS) also has migration data. However, the CPS has a small sample size. For example, only a few hundred physicians are in any given CPS year while the total number of physicians in the ACS over the entire period was more about 33,000.

[14] It should be noted that in 2000, the ACS sample of physicians was 1,119 but grew (as did the entire ACS sample) in 2001 to nearly 3,500. In 2005, the ACS was expanded to its full-size.

In this paper, we employ the more general approach of Klick and Stratmann (2007) and allow reform variables to enter the model independently so that any differential effects of a particular reform can be measured. The five measures of medical malpractice reform included into the empirical model are

- non-economic damage caps

- joint and several liability reform

- collateral source rule reform

- mandatory periodic payment of judgments

- patient compensation fund.

Each reform variable is a dichotomous variable that equals "1" if the state the physician resided in last year had the reform and zero otherwise. Each of the included reforms is described in more detail in Table 3.

Table 3

Medical Liability Reforms

Reforms	Description
Cap on Non-economic Damages	The damages for pain and suffering that can be awarded are capped at a specific dollar level.
Joint and Several Liability Reform	Joint and several liability is abolished so joint defendants are not subject to paying an entire damage award.
Collateral Source Rule Reform	Collateral Source rule is abolished so juries can know sources of compensation had by claimant from other sources (such as insurance).
Patient Compensation Fund	A patient compensation fund exists. Patient compensation funds are government sponsored excess liability programs for medical malpractice claims.
Mandatory Periodic Payment of Judgments	Mandatory periodic payment of judgment requires any judgment to be paid over a period of time rather than as a lump sum.

Summary statistics for the final sample used to estimate equation (2) can be seen in Appendix A.1. The restrictions on the full ACS sample include being thirty-five years or older, being less than sixty-five years old, and reporting being in the labor force. The minimum age of thirty-five was used to exclude movement of new physicians entering or leaving residences at the start of a career and the age sixty-five cutoff was meant to exclude end-of-career decisions that may be unrelated to malpractice climates.[15] In addition, individuals that lived in the District of Columbia or moved to or from outside the United States were excluded since malpractice reform data was not available.

4.2 Results

Equation (2) is estimated using OLS with robust standard errors using dentists as one control group and then using the entire other health practitioners group defined by the Census as another control group.[16] The results of both estimations for the variables of interest can be found in Table 4. Column (1) reports the difference-in-difference estimates comparing physicians and dentists and column (2) reports the difference-in-difference estimates comparing physicians and the larger other health practitioners category.[17] The full results can be found in Appendix A.2.

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[15] Of course, the severity of malpractice climates in states may impact where new physicians locate and the retirement decision of older physicians. The annual move rates across states for physicians in the ACS during the years under study are: 13 percent for physicians under age 35; 2.2 percent for physicians in the 35-64 age category used in this paper; and 0.5 percent for physicians over age 64.

[16] The "Health Diagnosing Occupations" are physicians, dentists, veterinarians, chiropractors, optometrists, podiatrists, and others. We exclude veterinarians as their health market is significantly different than the others. However, their inclusion does not materially alter the results.

[17] Klick and Stratmann (2007) term this approach a "triple difference" because of the use of two control groups—physicians in states without reforms and the use of an additional within-state control group.

Table 4

Impact of Medical Liability Reforms on Physician Moves

	Coefficient Estimate (t-stat) Column 1 (MD and Dentists)	Coefficient Estimate (t-stat) Column 2 (MD and Other Health Practitioners)
MD	0.014*	0.018*
	(2.58)	(4.40)
Cap on Non-economic Damages	-0.001	0.000
	(0.23)	(0.04)
Joint and Several Liability Reform	0.005	0.005
	(0.48)	(0.49)
Collateral Source Rule Reform	-0.004	-0.006
	(0.44)	(0.67)
Patient Compensation Fund	-0.001	0.010
	(0.05)	(0.44)
Mandatory Periodic Payment of Judgments	-0.001	0.004
	(0.10)	(0.57)
MD * Cap on Non-economic Damages	-0.009*	-0.009*
	(2.38)	(2.75)
MD * Joint and Several Liability Reform	-0.007	-0.012*
	(1.38)	(2.94)
MD * Collateral Source Rule Reform	0.004	0.006
	(1.00)	(1.46)
MD * Patient Compensation Fund	-0.009+	-0.007+
	(1.72)	(1.73)
MD * Mandatory Periodic Payment of Judgments	0.005	0.004
	(1.17)	(0.96)
	n = 26,643	n = 29,853
	Years: 2000-2006	

Note - + indicates significant at the 10% level and * indicates significant at the 5% level.
State and year fixed effects along with standard demographic controls are included with robust standard errors.
Estimation includes fulltime workers between the ages of 35 and 64.
Full regression results can be found in Appendix A.2

The estimated coefficients on each of the five reform variables measures the effect of

reforms on the moves of the within-state control group (dentists and other health practitioners,

respectively), while the interaction term between the reforms and MD represents the estimated effect of each reform on the moves of physicians. The marginal effects of these reforms on the probability of a physician moving out of state are reported in tables 5a and 5b. We prefer the results that use other health practitioners as a control group merely because it is a much larger group than dentists—as shown in table 4 there are 3,210 more individuals in this larger control group.

The first noteworthy finding is that the estimated coefficient of *Cap on Non-economic Damage*s is quantitatively small and statistically insignificant in both estimations. This implies that caps on non-economic damages do not have an impact on the moves across states of dentists and other health practitioners. However, the coefficient estimate on the interaction term of *MD* and *Cap on Non-economic damages* is negative and significant in both estimations. These results imply that for states that have instituted non-economic damage caps a physician is less likely to move. The estimated effect is both significant in statistical and economic terms and is materially the same in both approaches. This finding is consistent with the larger literature that has often found that non-economic damage caps are an important predictor of physician population levels. It is also consistent with the Helland and Showalter (forthcoming) finding that liability exposure impacts the hours worked of physicians.

Interestingly, more than just non-economic damage caps were found to be important. While the *Joint and Several Liability Reform* dichotomous variable is insignificant in both estimations, the interaction with *MD* is significant and negative in the second estimation which includes other health practitioners as a control group. The coefficient estimate is nearly significant in the first estimation where only dentists are used as the control. Taken in whole,

these results provide some evidence that implementing a joint and several liability reform tends to reduce the likelihood of a physician moving out of the state.

It is worth mentioning that when we estimate equation (2) using the full sample of physicians (all age groups) and do not include any of the individual level control variables, the estimated impact of joint and several liability reform is almost double the magnitude of the effect reported in table 5b. This difference shows one virtue of using micro data—individual level controls can be included and we can exclude the youngest and oldest age groups who may be more likely to move states for reasons unrelated to malpractice climates relative to the physicians aged 35-64 who are used here.[18]

While the coefficient on *Patient Compensation Fund* is insignificant, the estimated coefficient on the interaction with *MD* is negative and statistically significant at the 10% level in both estimations. This implies that having a patient compensation fund reduces the chance of a physician leaving a state.

In addition, the empirical results are robust to changes in age restrictions and the inclusion/exclusion of demographic variables. The only exception to this is, as mentioned previously, that the estimated effect of joint and several liability increases substantially when the age restrictions and demographic variables are excluded.

Table 5 and table 6 report the estimated marginal effect of each reform on the probability a physician moves states. The effect of a state implementing a cap on non-economic damages is that a physician is almost 1 percentage point less likely to move than in a state without this reform. This result may seem small. However, considering that on average 2.2% of the physician sample moves in any given year, non-economic damage caps lead to an average

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[18] It may be valid to include the youngest and oldest physicians in the analysis, but we exclude them in order to be cautious in our approach.

reduction on the probability of moving by about 40.6 percent in one specification and 41.4 percent in our preferred specification. A state that has joint and several liability reform lowers the probability that a physician moves by about 0.69 percentage points, equivalent to about a 31.5 percent decrease in the chance of a move in one specification (a result that is not statistically significant) and a decrease of about 55.7 percent in our preferred specification. This latter result is statistically significant. The results for patient compensation funds are similar. For a state that has a patient compensation fund, the probability of moving is roughly 39.3% lower in the first specification and 32.9% lower in our preferred specification. To repeat, we prefer the latter specification only because the control group of other health practitioners is larger than in the former specification—which only uses dentists.

The results of this research are also informative in what is *not* found to have an effect on physician location decisions. *Collateral Source Rule Reform* and *Mandatory Periodic Payment of Judgments* are not found to be statistically significant influences on the probability that a physician will relocate. While this result does not mean these liability reforms have no impact on a state's malpractice climate, no evidence was found that they specifically impact physician location choices.

Table 5

Marginal Effects of Medical Liability Reforms on Physician Migration

With Dentists as the Comparison Group

Reform	Coefficient on Interaction	Marginal Effect (relative to the mean probability of moving)
Cap on Non-economic Damages	-0.0089*	-40.6%
Joint and Several Liability Reform	-0.0069	-31.5%
Collateral Source Rule Reform	0.0043	19.6%
Patient Compensation Fund	-0.0086+	-39.3%
Mandatory Periodic Payment of Judgments	0.0054	24.4%

Note - + indicates significant at 10% level and * indicates significant at the 5% level.

Table 6

Marginal Effects of Medical Liability Reforms on Physician Migration

With All Practitioners as the Comparison Group

Reform	Marginal Effect	Marginal Effect (relative to the mean probability of moving)
Cap on Non-economic Damages	-0.0091*	-41.4%
Joint and Several Liability Reform	-0.0123*	-55.7%
Collateral Source Rule Reform	0.0058	26.5%
Patient Compensation Fund	-0.0072+	-32.9%
Mandatory Periodic Payment of Judgments	0.0038	17.5%

Note - + indicates significant at 10% level and * indicates significant at the 5% level.

In addition to these multivariate results, we looked at the malpractice climates of sending and receiving states for physicians who moved states in the American Community Survey (ACS) data. For the sample of physicians aged 35-64, which is the sample used to generate the results in tables 4 and 5, we tabulated the change in the probability of living in a state with each of the five malpractice reforms. As shown in table 7, physicians in the ACS who moved states during the time period under study were much more likely to live in states with caps on non-economic damages and patient compensation funds after their move. On the other hand, these movers were less likely to be in states with collateral source rule reforms or mandatory periodic payment of judgments after their move. There is a more modest increase in the percent of physicians who reside in states with a joint and several liability reform after a move (3.6 percent).

Table 7

Change in Probability of Living in a State with Each Malpractice Reform

(Movers Only)

Reform	Change in Probability of Living in a State with Each Reform After a Move
Cap on Non-economic Damages	25.0%
Joint and Several Liability Reform	3.6%
Collateral Source Rule Reform	-7.7%
Patient Compensation Fund	30.6%
Mandatory Periodic Payment of Judgments	-5.1%

While our findings show that states without some liability reforms lose doctors to states that have these reforms, we do not analyze the issue of whether less severe malpractice climates lead to lower quality medical care. Klick and Stratmann (2007), for example, provide evidence that collateral source reform leads to higher rates of infant mortality for some groups.

5. Conclusion

This paper expands the current body of knowledge on the impact of medical liability reforms by taking the research to the micro-level—the physician level—and by analyzing the effects of five specific liability reforms on the mobility of physicians between states. To our knowledge, we are the first study to analyze the effect of malpractice climates on the supply of physicians using information from the second large wave of malpractice reforms, the decade of the 2000s.

We find robust evidence that non-economic damage caps impact physician populations. This finding is present in the majority of the prior literature. However, we also provide some evidence that joint and several liability reform and patient compensation funds impact physicians' location decisions; a finding which has not been detected in the prior literature.

Although the estimated magnitudes of specific liability reforms on physician moves are significant, we believe that our estimates provide a cautious view of the total effect of liability reforms on the supply of physicians for at least five reasons:

- We do not model the intensive margin of the labor supply of physicians. Helland and Showalter (forthcoming) find that medical malpractice climates impact the hours worked by physicians.

- We do not model the initial location decisions of new physicians, and younger
  physicians are more likely to move out of states that do not have four of the five medical
  malpractice reforms considered in this paper.

- We do not model the effect of medical malpractice climates on the retirement decisions
  of physicians. Kessler, et al. (2005) finds that more severe liability climates increase the
  likelihood of physician retirements.

- Like most other studies, we do not precisely measure the medical malpractice climate in
  each state, which leads to an errors-in-variables bias of our coefficients of interest
  toward zero.

- As discussed above, our empirical approach is cautious.

The findings in this paper shed light on one aspect of an important and contentious policy
issue—the effect of medical malpractice law on the supply of physicians. The inference from
this work is that physicians are less likely to move away from states and to move to states that
have implemented certain medical malpractice liability reforms. The magnitude of the effects on
physician moves is large for policy purposes. However, other questions not addressed in this
paper such as the effect of malpractice liability climates on health outcomes need to be addressed
to assess to overall desirability of malpractice reform.

Appendix A.1
Sample Summary Statistics

	Mean	Std. Dev.
Moved (2.2% of Physicians Moved)	0.02	0.14
Physicians	0.73	0.45
Dentists	0.17	0.37
Optometrists	0.03	0.18
Podiatrists	0.01	0.10
Other Health Care Practitioner	0.06	0.24
Cap on Non-economic Damages	0.43	0.49
Joint and Several Liability Reform	0.81	0.40
Collateral Source Rule Reform	0.71	0.45
Patient Compensation Fund	0.19	0.39
Mandatory Periodic Payment of Judgments	0.68	0.47
White	0.83	0.38
Age	47.82	7.83
Female	0.25	0.43
Married	0.82	0.38
Number of Children less than 5	0.20	0.52
Year 2000	0.03	0.18
Year 2001	0.10	0.31
Year 2002	0.10	0.29
Year 2003	0.11	0.31
Year 2004	0.11	0.32
Year 2005	0.27	0.44
Year 2006	0.28	0.45
Alabama	0.01	0.11
Alaska	0.00	0.07
Arizona	0.02	0.13
Arkansas	0.01	0.08
California	0.12	0.33
Colorado	0.02	0.13
Connecticut	0.01	0.12
Delaware	0.00	0.07
Florida	0.06	0.23
Georgia	0.02	0.15
Hawaii	0.01	0.09
Idaho	0.00	0.07
Illinois	0.04	0.20
Indiana	0.02	0.13
Iowa	0.01	0.10
Kansas	0.01	0.09
Kentucky	0.01	0.12
Louisiana	0.01	0.12
Maine	0.01	0.08
Maryland	0.03	0.16
Massachusetts	0.03	0.17
Michigan	0.03	0.18
Minnesota	0.02	0.13
Mississippi	0.01	0.09
Missouri	0.02	0.13

Appendix A.1 Continued
Sample Summary Statistics

	Mean	Std. Dev.
Montana	0.00	0.06
Nebraska	0.01	0.08
Nevada	0.01	0.08
New Hampshire	0.01	0.09
New Jersey	0.04	0.19
New Mexico	0.01	0.07
New York	0.08	0.27
North Carolina	0.03	0.16
North Dakota	0.00	0.07
Ohio	0.04	0.19
Oklahoma	0.01	0.09
Oregon	0.01	0.12
Pennsylvania	0.05	0.21
Rhode Island	0.01	0.08
South Carolina	0.01	0.11
South Dakota	0.01	0.08
Tennessee	0.02	0.13
Texas	0.05	0.23
Utah	0.01	0.09
Vermont	0.01	0.08
Virginia	0.02	0.15
Washington	0.02	0.15
West Virginia	0.01	0.08
Wisconsin	0.02	0.13
Wyoming	0.00	0.06

Source: Authors' calculations using American Community Survey (2000-2006) and Ronen Avraham's *Database of State Tort Law Reforms* (DSTLR, 2nd)

Appendix A.2
Impact of Medical Liability Reforms on Physician Moves

	Coeff. Estimate (t-value)	Coeff. Estimate (t-value)
MD	0.014*	0.018*
	(2.58)	(4.40)
Cap on Non-economic Damages	-0.001	-0.0002
	(0.23)	(0.04)
MD * Cap on Non-economic Damages	-0.009*	-0.009*
	(2.38)	(2.75)
Joint and Several Liability Reform	0.005	0.005
	(0.48)	(0.49)
MD * Joint and Several Liability Reform	-0.007	-0.012*
	(1.38)	(2.94)
Collateral Source Rule Reform	-0.004	-0.006
	(0.44)	(0.67)
MD * Collateral Source Rule Reform	0.004	0.006
	(1.00)	(1.46)
Patient Compensation Fund	-0.001	0.01
	(0.05)	(0.44)
MD * Patient Compensation Fund	-0.009+	-0.007+
	(1.72)	(1.73)
Mandatory Periodic Payment of Judgments	-0.001	0.004
	(0.10)	(0.57)
MD * Mandatory Periodic Payment of Judgments	0.005	0.004
	(1.17)	(0.96)
White	-0.008*	-0.008*
	(3.15)	(3.19)
Age	-0.008*	-0.007*
	(5.00)	(4.89)
Age Squared	0.000*	0.000*
	(4.50)	(4.38)
Female	-0.003	-0.002
	(1.40)	(0.94)
Married	-0.019*	-0.018*
	(6.50)	(7.02)
Number of Children less than 5	0.001	0.002
	(0.61)	(0.92)
	N = 26,643	N = 29,853

*Note - + indicates significant at the 10% level and * indicates significant at the 5% level.*
State and year fixed effects are included with robust standard errors.
Estimation includes fulltime workers between the ages of 35 and 64.

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