Determinants of Medical Malpractice Insurance Premiums

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Abstract

For most doctors, obtaining medical malpractice insurance coverage each year represents a significant expense. During the last three decades, researchers have developed several competing theories to explain changes in the cost obtaining of medical malpractice insurance in the United States. This article focuses on the relationship, on a nationwide basis, between medical malpractice awards, the presence of tort reform, insurers' return on investments, and the impact of each upon the cost of obtaining medical malpractice insurance. The results of a multivariate equation are then used to analyze the relative impacts of these competing theories.

1. Introduction

During the past three decades, inflation-adjusted medical malpractice insurance[1] premiums per doctor have risen and fallen dramatically[2]. A spirited debate has ensued regarding which factors are most significant in explaining the changes in such premiums. One theory is that a decrease in an insurer's return on its investment portfolio has the effect of increasing medical malpractice insurance premiums. A second is that malpractice premiums are the direct result of medical malpractice awards and settlements. States with higher than average medical malpractice awards are the same states with higher than average malpractice insurance premiums[3]. A third theory is that an increase in passage of state-level tort reform changes the likelihood of massive settlements or judgments in malpractice cases, and thus, the legislation has the effect of decreasing such premiums by reducing insured risk.

In many parts of the U.S., during certain time periods, medical costs have been rising faster than the overall rate of inflation. Rising premiums represent a cost that

[1] Medical malpractice insurance provides coverage for members of the medical profession for liability resulting from claims of professional negligence. *See* Neale *et al*. "Dynamics of the Insurance Market for medical Malpractice Insurance". The Journal of Risk and Insurance, 2009, Vol.76, No.1, pg 221-47, pg. 221 .

[2] See Appendix A.

[3] Moreover, time periods in which higher than average medical malpractice awards occur are the same time periods in which higher than average medical malpractice insurance premiums occur.

doctors have to pass on to the patient in the form of higher prices for services and potentially in the harder-to-measure form of added precautionary medical services.[4]

This research focuses upon the relationship, on a nationwide basis, between medical malpractice awards, insurers' return on investments , the presence of tort reform, and the cost of medical malpractice insurance premiums. Because many insurers operate in more than a single state, it would be difficult to conclude that all of the costs associated with massive jury awards, settlements, or gains/losses accruing from insurance companies' investments would be confined to a single state, regardless of the current legislative climate involving malpractice[5]. Based on this, we estimate the cost of medical malpractice insurance premiums for the nation overall using independent variables including malpractice awards, insurers' return on investments, and the existence of tort reform. We focus primarily on the results of a multi-variate regression to analyze the

[4] A study by Dubay, Kaestner and Waidmann, (1999, Journal of Health Economics) provides evidence that physicians are more likely to order unnecessary cesarean procedures in obstetrics to avoid litigation, but that the impact of increased cesarean sections to mitigate malpractice lawsuits on total obstetric care costs is relatively small and varies with the socioeconomic status of the mother.

[5] Scant information exists regarding the potential for malpractice insurance providers spreading their costs (or losses) directly (or indirectly) across state lines. The implicit assumption of most arguments made in favor of comprehensive malpractice and tort reform is that malpractice awards are confined to a single state, and as such, the impact of massive jury awards or settlements will only be important for insurance costs, and subsequently medical costs, within that particular state where the award or settlement occurred. If, however, malpractice insurance companies operate in multiple states, there is the possibility that tort reform legislation in one state will have spillover impacts on insurance costs in other states without caps on malpractice payouts, and payouts in states without caps may have the effect of increasing premiums in states with caps.

above-mentioned theories that compete to explain changes in the cost of medical malpractice insurance in the U.S.

2. Literature Review

A number of researchers have analyzed the rise in medical malpractice insurance premiums (Gius, 1998; Helland & Showalter, 2009; Hillman & Cluff, 2003; Kessler, 2006; Kilgore, Morrisey, & Nelson, 2006; Lai & Witt, 1992; Neale, Eastman, & Peterson Drake, 2009; Viscusi & et al., 1993) . Lai and Witt (1992) examined the effect of insurer expectations upon the supply and cost of premiums.[6] Lai and Witt sought to explain the growth rate of premiums in terms of: 1) the change in the growth rate of losses and expenses and 2) the variance in the growth rate of expenses. Their research concluded that increases in the mean and dispersion of losses and expenses did explain the increase in premiums.[7]

In "Dynamics of the Market for Medical Malpractice Insurance", Neale *et al* (1992) built upon Lai and Witt's prior research. Neale *et al* examined the stability of the market for medical malpractice insurance by analyzing financial data from 1993-2003 collected by the National Association of Insurance Commissioners (NAIC). The variables analyzed by Neale *et al* included the number of insurers writing medical malpractice

[6] Lai, G., and R. Witt. 1992, "Changed Insurer Expectations: An Insurance Economics View of the Commercial Liability Crisis Under Uncertainty", Journal of Insurance Regulation 10(3): 342-292. Reference of Neal et al. p, 245.

[7] Neale et al. p225.

insurance, the relationship between growth rates of premiums and losses, variance losses, and investment income.[8]

The research of Neale *et al* differs methodologically from that of Lai and Witt. Neale *et al* consider "losses incurred" rather than "losses paid"[9]. The variable "losses incurred" takes into account the fact that insurers price their policies based upon expected future losses. Accordingly, "losses incurred" is thought to allow for flexibility in testing changing expectations.[10]

Neale *et al* sought to confirm the presence of market instability in the data they analyzed. To do this, they chose to use the bivariate Granger causality model. It allows for the estimation and comparison of the explanatory strength of two variables for purposes of determining whether past losses predict premiums, or, in the alternative, whether past premiums predict losses.[11] Neale *et al* noted that the first relationship contained more explanatory power than the second. Thus, a causal relationship exists between direct losses and net premiums written.[12] Of the years examined, 2001 proved to be the most unstable. Stated alternatively, the most significant misalignment between direct losses incurred and net premiums written occurred in 2001.[13]

After establishing the presence of market instability, Neale *et al.* set out to examine the effect of selected variables --growth rates of net premiums written, direct

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[8] Neale et al. p226.

[9] By way of analogy, "losses incurred" is more akin to an accrual-based accounting concept, whereas "losses paid" is more akin to a cash-basis accounting concept.

[10] Neale et al. p225.

[11] Neale et al, p227.

[12] It should be noted that the causality was not consistent each year (Neale et al, p231).

[13] Neale et al, p231.

losses incurred, direct defense and cost containment fees, and total losses incurred—upon the market over time. The authors recognized that the data might be distorted by the fact that insurers may enter a market when few net premiums are written and there are little or no direct losses and/or leave a market when few net premiums are written but there are large direct losses.[14] To account for such distortion, both mean and median growth rates were considered. Neale *et al* observed that the median growth rate of direct losses incurred increased in all years except 1995, 1998, and 2000.[15] The authors deduced that "losses, premiums, defense costs, and claim containment fees do not necessarily grow in a similar manner".[16]

In testing for the effects of changes in the variables over time, Neale *et al.* expected that a strong, positive relationship between premiums and losses would continue to exist over time. Premiums and losses were expected to increase at the same natural rate so long as the rate of investment income growth remained constant.[17] To test this, Neale *et al* used geometric growth rates to reduce the risk of bias.[18]

The performance of insurers over time revealed that the growth of policyholder surplus has declined since 1994 while the growth in net investment income has steadily deteriorated from 1993 to 2000.[19] The authors concluded that insurers' actions to increase premiums are justified because the growth rate of losses has exceeded the growth rates of

[14] Neale et al, p231.

[15] Neale et al, p233.

[16] Neale et al, p233.

[17] Neale et al, p 234.

[18] By way of contrast, Lai and Witt used arithmetic growth rates.

[19] Neale et al, p 236.

premiums. Thus, the instability in medical malpractice insurance appears to be driven by the direct losses incurred by the insurance companies. Furthermore, the data suggest that changes in the underwriting and legal systems do contribute to the growth of losses and related growth of medical malpractice insurance premiums.

In "Medical Malpractice Insurance: Multiple Factors Have Contributed to Increased Premium Rates" (June 2003), the General Accounting Office (GAO) analyzed data relating to seven states: California, Florida, Minnesota, Mississippi, Nevada, Pennsylvania, and Texas. The GAO study sought to: 1) describe the extent of increases in medical malpractice insurance rates; 2) analyze the factors that contributed to those increases; and 3) identify changes in the medical malpractice insurance market that might make premium rates different from that of past periods (most notably the periods from 1970-75 and 1975-1989).

The GAO concluded that insurers' losses, declines in investment income, a less competitive climate, and climbing reinsurance[20] rates have all contributed to changes in premium rates.[21] Analysis by the GAO identified increased losses on claims as the primary contributor to higher medical malpractice premium rates. The 15 largest medical malpractice insurers in 2001 (with a combined market share of 64.3%) incurred losses (including both payments to plaintiffs to resolve claims and the costs associated with defending those claims) of approximately 78% of the insurer's total expenses.[22] Because

[20] Reinsurance is also known as excess loss coverage.

[21] GAO, p15.

[22] GAO, p16.

insurers base their premium rates on their expected costs, the GAO indicated that anticipated losses were the primary determinant of premium rates.[23]

In all seven states sampled, aggregate incurred losses increased substantially after 1998. Mississippi and Pennsylvania experienced the highest increases (197.5% and 97.2%, respectively). The GAO anticipated that paid losses –and, thus, premium rates-- would continue to rise from 2003-2006 in accordance with insurers' higher expectations of losses.

The GAO also explored the effect of tort legislation enacted into law in the mid-1970s that occurred in some of the states that it sampled. Such legislation is designed to reduce insurers' losses by limiting the number of claims filed, the size of awards and settlements, and the time and costs associated with resolving claims.[24] For the states which did not enact tort reform, the GAO anecdotally observed the effects of imposed caps on non-monetary losses such as pain and suffering.[25] Both tort reform and caps on non-monetary losses led to a reduction in the severity and frequency of claims filed in those states. As such, the expectations of insurers' losses may have been affected by past -- or the potential for future -- tort legislation, resulting in lower real insurance costs per doctor in the mid-2000s.

A report entitled *The Determinants of the Cost of Medical Liability Insurance* (Kessler, 2006) analyzed data from the Texas Department of Insurance (TDI) and the National Association of Insurance Commissioners (NAIC). Kessler observed that direct losses plus loss adjustment expenses incurred accounted for approximately 87% of

[23] GAO, p16.

[24] GAO, p41.

[25] GAO, p41.

malpractice insurers' expenses.[26] Further, Kessler noted that, according to the NAIC, total incurred losses in medical malpractice increased in real terms by 178.2% from 1991 to 2003 (94.5% per capita).[27] This led Kessler to observe:

> If other insurers' expenses remained roughly constant, a very simple, competitive model of the industry would predict that premium rates should have increased by approximately 82%,[28] strikingly similar to the increase of 71 percent in the professional liability insurance component of the CMS Medicare Economic Index Market Basket.[29]

Other variables explored by the GAO and Neale *et al* were considered by Kessler as only marginally explanatory regarding the increase of premium rates. Kessler noted that "low entry barriers, declines in insurer investment income or increases in health care costs can account for at most a small fraction of the increase in premiums".[30] Kessler concluded that increases in tort awards, settlement payments, and defense costs explain why premiums have risen. Accordingly, reforms to the tort laws of various states --such as reasonable caps on non-economic damages-- substantially reduce the cost of insurance claims and, in turn, premiums.

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[26] Kessler, p15.

[27] Kessler, p15.

[28] Computed as follows: 87% x 94.5%.

[29] Kessler, p 15.

[30] Kessler, p23.

Helland and Showalter (2009) examined the impact of malpractice reforms in the years 1983 and 1988 using Florida malpractice awards data. They used measure of liability risk based on incurred losses to estimate the impact of malpractice reform on physician labor market behavior (specifically the number of hours worked by doctors). They estimated the labor elasticity of liability exposure to be -0.285 for the pooled sample of physicians and -1.224 for physicians age 55 or older. This suggests that older physicians are substantially more sensitive to changes in liability risk than are younger physicians. Further, Helland and Showalter estimate that an increase of $1 in expected liability should increase medical malpractice premiums by between $.70 and $1.05.

3. Data and Estimation

Existing research in this area has set forth several competing hypotheses involving medical malpractice insurance premiums that are "directional" in nature. In simplified form, they can be described as follows:

Hypothesis #1	If medical malpractice awards increase, then	medical malpractice insurance premiums will increase.
Hypothesis #2	If insurers' investment returns decrease, then	medical malpractice insurance premiums will increase.
Hypothesis #3	If, for a given year, the total number of states that have, or have enacted, medical tort reform increases,[31] then	medical malpractice insurance premiums will decrease.

In this article, we estimate real direct premiums per doctor (RDPPD) as a function of: 1) real direct losses per doctor (RDLPD), 2) several measures of the overall performance of investments, and 3) a dummy variable measuring existing statutory malpractice award limits within states each year. For purposes of our analysis, we use both a standard ordinary least squares (OLS), first-difference estimation, and distributed lag regression.

Because we use annual national-level data from 1975 to 2008 for all variables, we estimate parsimoniously to conserve degrees of freedom in our models. With regard to the independent variables, we could not find adequate data involving yearly total medical

[31] For purposes of our analysis, we will assume that an increase in medical malpractice tort reform will result in a decrease in medical malpractice awards.

malpractice awards in the United States. While some awards are made available to the public, many are not. For example, many malpractice awards are structured as legal settlements subject to nondisclosure provisions. Accordingly, we use direct losses paid per doctor as a "proxy" for yearly total medical malpractice awards. We use annual insurance industry data involving direct losses paid per doctor contained in a recent consumer health publication (Hunter, Cassell-Stiga, & Doroshow, 2009). We obtain the monthly closing index value of the S&P 500, treasury bills, and treasury bonds, calculate the continuous rate of return for each, and use each separately as a proxy for insurers' investment returns during that period. For the independent variable measuring the presence of tort reform, we use original constructed data compiled by examining the laws of each state during the period 1975-2010. For a given year, if a state has a medical tort reform law on its books, a value of "1" is assigned. If not, the state is assigned a value of "0". For a state to receive a "1," there must be a law in place that places a strict limit on non-economic damages (also referred to as "pain and suffering" awards). Each year, the sum of the values for all 50 states is computed as an indicator of the number of states with damage caps. The resulting number is used to track the prevalence of tort reform in the United States during the period 1975-2010.

During the period, the annual rate of return for the S&P 500 averaged about 8.5 percent, whereas the entire stock market averaged a return of more than 13 percent (see Table 1). During the period, on average, fewer than 1 additional state adopted non-economic damage caps per year. Direct premiums (RDPPD) averaged more than twice the direct losses paid (RDLPD) and the rate of return averaged about 5.5% for treasury bills to 13% for the stock market.

Table 1: Descriptive Statistics for Selected Variables

Variable	Mean	St. Dev.	Min	Max
RDPPD	15819.14	3675.213	10970.23	22881.47
RDLPD	7084.916	1807.136	3231.54	9425.2
STATE_TORT	16.52941	8.951842	2	29
NEWSTATETORT	0.852941	2.002004	0	11
S&P_ROR	8.508857	17.14148	-37.28	34.52
STOCKROR	13.1342	17.0702	-36.58	37.2
TBILLSROR	5.4797	3.1919	0.13	14.3
TBONDSROR	8.3236	10.1672	-11.12	32.81

Since we are estimating with time series data, it is important to test for a unit root process in our data series. The validity of the OLS estimation process depends on the data being stationary. If the process is non-stationary, the use of OLS can produce spurious regression, upwardly biasing the t-stats and R-square. We perform a modified Dickey–Fuller t test for a unit root in which the series has been transformed by a generalized least-squares regression (see Table 2). It tests if a variable follows a unit-root process. The null hypothesis is that the variable contains a unit root --a non-stationary process-- and the alternative is that the variable is generated by a stationary process. We test up to nine lagged periods, rejecting the null in only one of the nine at the 0.1 level of significance. However, several of the test statistics are only slightly outside the rejection region. For this reason, we present both the OLS and the first-difference regression results.

Table 2: Modified Dickey-Fuller T-test Results

Lags	**Test Statistic**	**1%**	**5%**	**10%**
9	-2.775	-3.77	-2.811	-2.388
8	-2.278	-3.77	-2.788	-2.406
7	-1.398	-3.77	-2.814	-2.46
6	-1.707	-3.77	-2.879	-2.542
5	-1.722	-3.77	-2.971	-2.643
4	-2.346	-3.77	-3.08	-2.754
3	-2.792	-3.77	-3.195	-2.866
2	-2.666	-3.77	-3.305	-2.97
1	-2.931	-3.77	-3.4	-3.058

Let us first consider a parsimonious model that uses the rate of return on US Treasury Bonds (TBONDS_ROR).[32] The first model is estimated with all contemporaneous variables. The results are summarized in Table 3. The only variable that is a significant determinant of the direct premiums paid per doctor is the presence of more states with tort reform laws. For each additional state that adopts legislation limiting non-economic damages, premiums are reduced by $195 per doctor per year. Higher rates of return are associated with lower premiums as well, but the impact is small and statistically insignificant for the contemporaneous period data. We estimate this equation with the average rate of return for Treasury bonds, Treasury bills, and the S & P

[32] Though not presented in our results in Table 3, we also estimate the impact of the rate of return from the S&P 500; however, the impact was not significantly correlated in the contemporaneous period.

500, but, in the standard OLS model, none of these measures of market return resulted in a p-value less than 0.51.[33] The variable direct losses per doctor (RDLPD) has the expected positive impact on insurance premiums. Each dollar lost per doctor is associated with $0.47 in added premium costs per doctor. Variation in the three independent variables explains only about 19 percent of the variation in the insurance premiums.

Table 3: OLS Regression Results

Variable	Coef.	t-stat	p-val
RDLPD	0.470642	1.26	0.217
STATES_TORT	-195.247	-2.63	0.013
TBONDS_ROR	-13.0057	-0.21	0.837
CONSTANT	15827.63	6.45	0
R-Sq	0.1894		

The impacts of investments, insurance payouts, and state tort laws may take longer than a year to affect insurance rates, especially when insurance premiums are likely to be paid once a year. To account for the potential for a lagged impact on premium prices, we estimate models that use lagged independent variables as determinants. To conserve degrees of freedom, we only estimate models with up to five periods of lags. The model that provides the best overall fit based on R-squared is the one that lags direct losses two periods and state tort reform laws 5 periods.[34] Treasury

[34] The optimal lag length for rate of returns on investment varies with the investment used in the regression.

bonds are lagged four periods (see Table 4A & 4B). Treasury bills are lagged one period (see Table 4B)[35]. The impacts of the lagged right hand side variables are both larger and more significant than those from the contemporaneous period.

Table 4A indicates that, when using treasury bonds as a proxy for investment rate of return, one additional state adopting tort reform legislation results in an average $350 decrease in malpractice premiums per doctor. This impact is significant at all typical confidence levels. The variable direct losses per doctor lagged two periods (L2_RDLPD) also has a significant impact upon yearly insurance premiums. This result suggests that if average losses increase by one dollar, premiums increase by more than what is required to offset the loss, or $1.33. Curiously, the rate of return on Treasury bonds four periods prior results in higher, rather than lower, malpractice insurance premiums, suggesting that as returns on Treasury bonds increase, premiums rise as well; however, this result is not significant at the 10 percent level.

[35] Regressions using the S&P 500 index are not presented since its inclusion produced no statistically significant impact on insurance premiums regardless of the lag period.

Table 4A: OLS Regression Results with Lags

Using Treasury Bonds

Variable	Coef.	t-stat	p-val
L2_RDLPD	1.336408	5.00	0.000
L5_STATES_TORT	-349.713	-7.60	0.000
L4_TBONDS_ROR	56.41591	1.58	0.126
CONSTANT	9701.303	4.98	0.000
R-Sq	0.7681		

Table 4B: OLS Regression Results with Lags

Using Treasury Bills

L2_RDLPD	0.902262	2.88	0.008
L5_STATES_TORT	-549.608	-6.82	0.00
TBILLS_ROR	-642.051	-2.67	0.013
CONSTANT	20035.42	4.67	0.00
R-Sq	0.8016		

Treasury bonds represent longer-term financial instruments, whereas Treasury bills are primarily short-term instruments. If, in the regression, we substitute the rate of return on Treasury bills for that on Treasury bonds, we find that a higher rate of return on Treasury bills results in significantly lower insurance premiums in the current year (see Table 4 above)[36]. A one percentage point increase in the Treasury bills' rate of return reduces

[36] In our model, we used contemporaneous rate of return on Treasury bills, as opposed to the rate of return on Treasury bonds lagged four periods.

average malpractice insurance premiums by $642 per doctor per year, as compared with $549 for an additional state with tort reform legislation.

To account for potential non-stationary data, we estimate the first-difference model with and without a constant term and with and without lags. All but the differenced model with lagged Treasury bonds provide similar results to the regression without the constant term. These results tell a compelling story. Contemporaneously, tort reform and medical malpractice insurance premiums may be endogenous. Although we use state tort reform laws to explain insurance premiums, it is just as plausible that current period higher premiums may lead to a higher likelihood that a given state will adopt malpractice reform laws.

The positive impact of the first difference in tort reform in the equations without lags indicates that higher premiums are associated with malpractice reform laws; however, the lagged values of tort reform legislation cannot be endogenous. It would be incorrect to suggest that current malpractice premiums have an effect on tort reform legislation five periods earlier. Therefore, let us focus on the third equations in both Table 5 and 6 (both in bolded text). These equations display a better overall fit than the fourth equations in both tables and the change in the Treasury bills' rates of return have a higher p-value in both models. In each of these table's third equation, an increase in losses per doctor is associated with significantly higher premiums. The presence of tort reform is associated with a substantial reduction in insurance premiums, which are also significant to at least the 2 percent level. Furthermore, an increase in the rate of return on Treasury bills is associated with a substantial reduction in insurance premiums, but the impact falls just shy of the 10% level of significance. These results suggest that direct

losses, tort reform, and investments each play a role in the determination of malpractice insurance premiums.

Table 4: Differenced Regression Results

with and without Lags

Dep. Variable = D_RDPPD	Coef.	t-stat	p-val
D_RDLPD	0.861	1.830	0.077
D_STATES_TORT	378.376	2.850	0.008
D_TBILLS_ROR	-249.017	-1.580	0.125
CONSTANT	-546.053	-1.930	0.063
R-Sq	0.332		
D_RDLPD	0.931	1.920	0.065
D_STATES_TORT	412.061	3.020	0.005
D_TBONDS_ROR	12.493	0.700	0.491
CONSTANT	-549.148	-1.880	0.071
R-Sq	0.286		
D_L2_RDLPD	**0.881**	**1.950**	**0.063**
D_L5_STATES_TORT	**-335.787**	**-2.600**	**0.016**
D_TBILLS_ROR	**-264.971**	**-1.590**	**0.125**
CONSTANT	**-10.495**	**-0.040**	**0.971**
R-Sq	**0.369**		
D_L2_RDLPD	2.561	2.080	0.048
D_L5_STATES_TORT	157.787	0.440	0.664
D_L4_TBONDS_ROR	51.741	1.080	0.289
CONSTANT	15020.000	19.920	0.000

R-Sq	0.163		

Table 5: Differenced Regression Results

with and without Lags (no constant term)

Dep. Variable = D_RDPPD	Coef.	t-stat	p-val
D_RDLPD	0.762	1.560	0.129
D_STATES_TORT	280.139	2.190	0.037
D_TBILLS_ROR	-242.647	-1.470	0.151
R-Sq	0.253		
D_RDLPD	0.828	1.650	0.109
D_STATES_TORT	311.764	2.390	0.023
D_TBONDS_ROR	10.453	0.560	0.578
R-Sq	0.208		
D_L2_RDLPD	**0.879**	**2.000**	**0.057**
D_L5_STATES_TORT	**-337.469**	**-2.850**	**0.009**
D_TBILLS_ROR	**-264.482**	**-1.620**	**0.117**
R-Sq	**0.375**		
D_L2_RDLPD	6.967	1.400	0.173
D_L5_STATES_TORT	3145.298	2.350	0.027
D_L4_TBONDS_ROR	209.611	1.090	0.288
R-Sq	0.208		

4. Conclusion

We find that changes in the number of states with tort reform legislation appear to be the primary reason for changes in medical malpractice insurance premiums. Interestingly, however, malpractice reform laws do not produce their desired impacts immediately. Our estimates suggest that a legislative change in a given state may take up to five years to have its maximum impact upon medical malpractice insurance premiums.

We also find that direct losses are associated with higher insurance premiums; and, as is the case with tort reform legislation, the impact of higher or lower payouts takes time to appear in the form of premium changes. Higher average losses translate almost dollar-for-dollar into higher average premiums, and, in at least one of our models, the impact of a dollar lost per doctor two periods prior results in more than a dollar increase in average premiums per doctor. This is consistent with the findings of Helland and Showalter (2009) in which an additional $1 of expected losses can increase premiums by up to $1.05 without controlling for the impact of investment rates of return.

We find that market rates of return are also associated with insurance premiums. However, the size and direction of the impacts depend upon the type of financial instruments measured, and the lag length of the returns. In some specifications, the magnitude of the impact of one-percentage point change in investment rates of return is comparable to those impacts from the presence of tort reform in one additional state. Among measures of investment returns, the average rate of return for Treasury bills, a relatively short-term investment instrument, has the strongest correlation across all model specifications. Furthermore, the rates of return for investment instruments are likely to be exogenous in the equation (i.e., rates of return on Treasury securities are not likely to

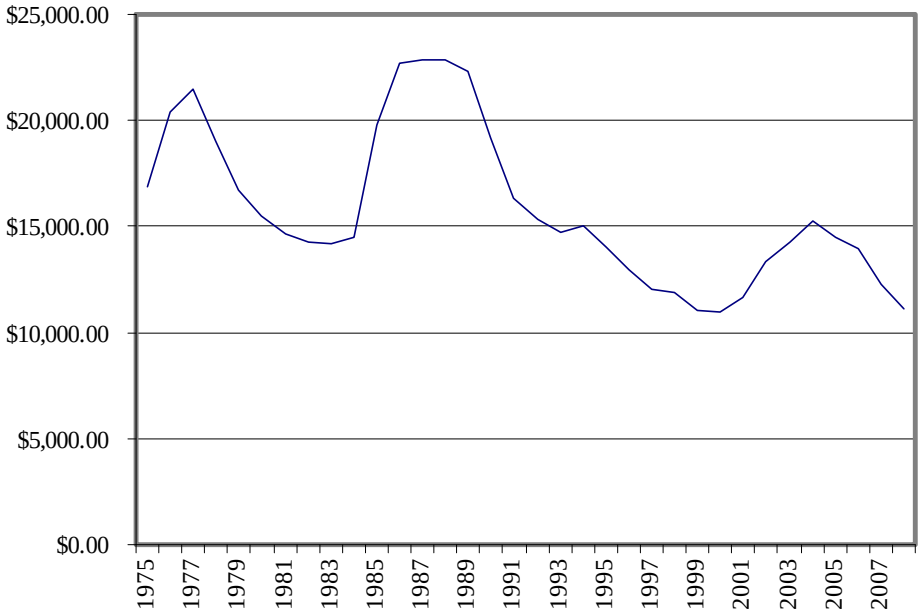
be determined by changes in malpractice premiums). Unfortunately, we do not have access to the actual investment portfolios of health insurance providers. Nevertheless, our results highlight that rates of return on short-term investments influence malpractice premiums independent of the existence of medical malpractice tort reform.

As mentioned earlier, a one percentage point increase in the rate of return of Treasury bills reduces real malpractice insurance premiums by $642 per doctor, as compared with $549 for an additional state enacting tort reform legislation. Taken together, the combined effect is $1,191 per doctor/per year/per medical malpractice insurance policy. This represents 11.9% of the average annual cost of a medical malpractice insurance policy.[37]

[37] Our calculation of the percentage of the average annual cost of a medical malpractice insurance policy per doctor is based on 2008 prices.

Appendix 1.

Figure 1: Direct Premiums Per Doctor (2008 Dollars)[38]



Data Source: (Hunter, Cassell-Stiga, & Doroshow, 2009)

[38] Data obtained from a report by Americans for Insurance Reform, *True Risk: Medical Liability, Malpractice Insurance and Health Care*, (2009).

Reference List

Gius, M. P. (1998). Using Panel Data to Estimate the Determinants of Medical Malpractice Insurance Premiums. *Applied Economics Letters, 5*(1), 37-39. doi: http://www.tandf.co.uk/journals/titles/13504851.asp .

Helland, E., & Showalter, M. H. (2009). The Impact of Liability on the Physician Labor Market. *Journal of Law and Economics, 52*(4), 635-663. doi: http://www.journals.uchicago.edu/JLE/home.html .

Hillman, R. J., & Cluff, L. (2003). Medical Malpractice Insurance: Multiple Factors Have Contributed to Increased Premium Rates (GAO-03-702 Medical Malpractice Insurance ed., Vol. GAO-03-702 Medical Malpractice Insurance). Washington, D.C.: United States General Accounting Office.

Hunter, J. R., Cassell-Stiga, G., & Doroshow, J. (2009). True Risk: Medical Liability, Malpractice Insurance and Health Care. New York, NY: Americans for Insurance Reform.

Kessler, D. (2006). The Determinants of the Cost of Medical Liability Insurance. *National Bureau of Economic Research*: Stanford University Graduate School of Business.

Kilgore, M. L., Morrisey, M. A., & Nelson, L. J. (2006). Tort Law and Medical Malpractice Insurance Premiums. *Inquiry, 43*(3), 255-270. doi: http://www.inquiryjournal.org .

Lai, G., & Witt, R. (1992). Changed Insurer Expectations: An Insurance Economics View of the Commercial Liability Crisis Under Uncertainty. *Journal of Insurance Regulation, 10*(3), 292-342.

Neale, F. R., Eastman, K. L., & Peterson Drake, P. (2009). Dynamics of the Market for Medical Malpractice Insurance. *Journal of Risk and Insurance, 76*(1), 221-247. doi: 10.1111/j.1539-6975.2009.01295.x .

Viscusi, W. K., & et al. (1993). The Effect of 1980s Tort Reform Legislation on General Liability and Medical Malpractice Insurance. *Journal of Risk and Uncertainty, 6*(2), 165-186. doi: http://www.springerlink.com/link.asp?id=10029 .