# Tort Reform and Physician Moral Hazard

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# Research Question

- States have been enacting tort reforms that reduce the liability of physicians who conduct malpractice

- Whether **physicians** exhibit **moral hazard** after tort reform?
  - *Moral hazard*: Physicians become more careless due to reduced financial liability
  - Use a regression-based actuarial model to predict incurred losses

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# Motivations

- Individual-level data are hard to obtain
- Insurance data are an aggregate of the individual-level data and may serve as a representative
- Medical malpractice insurers are the primary payer of medical malpractice claims
  - They have the *data* and *ability* to predict the behavioral changes of physicians and patients
  - Explore research question through the lens of medical malpractice insurers

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# Background of Tort Reform

- States have been *enacting* and *repealing* tort reforms
  - Most occurred before 2005, but there were still some after 2005
  - Study 5 types of tort reforms
    - Caps on noneconomic damages
    - Caps on punitive damages
    - Reforms to punitive damage evidence rules
    - Reforms to the collateral source rules
    - Reforms to the joint and several liability rules

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# Hypothesis

- Physicians exhibit moral hazard after tort reform
  - Physicians bear fewer costs of malpractice risk
    - Take fewer precautions and/or become more careless due to reduced liability
    - This can cause more malpractice claims and adversely affect patients' benefits
  - Patients must bear more costs of medical malpractice risk
    - Have to take more precautions, e.g., spend more time searching for a reliable physician or communicate more carefully with their doctor to decide an appropriate treatment
    - Once file a claim, the expected payment is reduced

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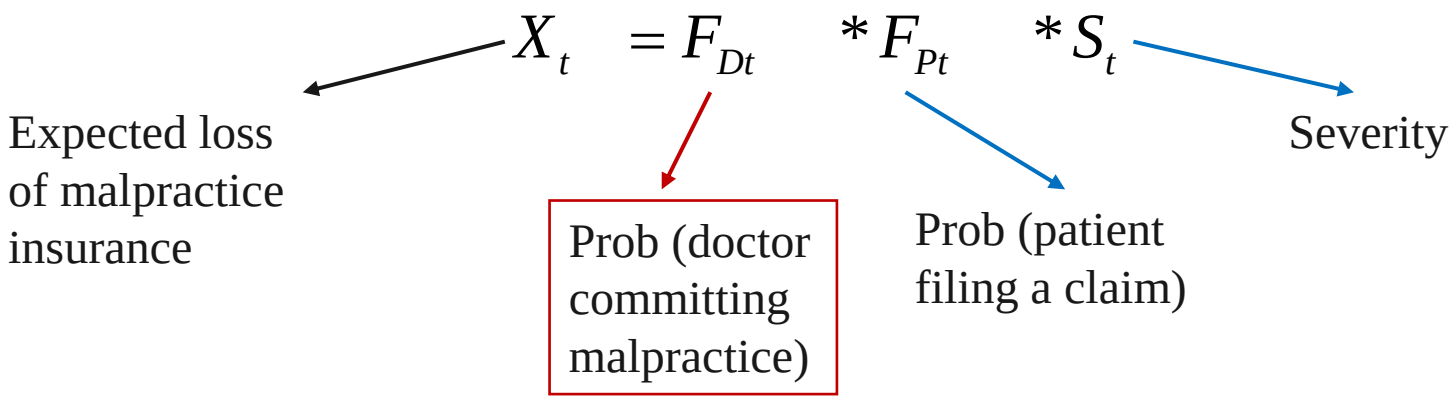
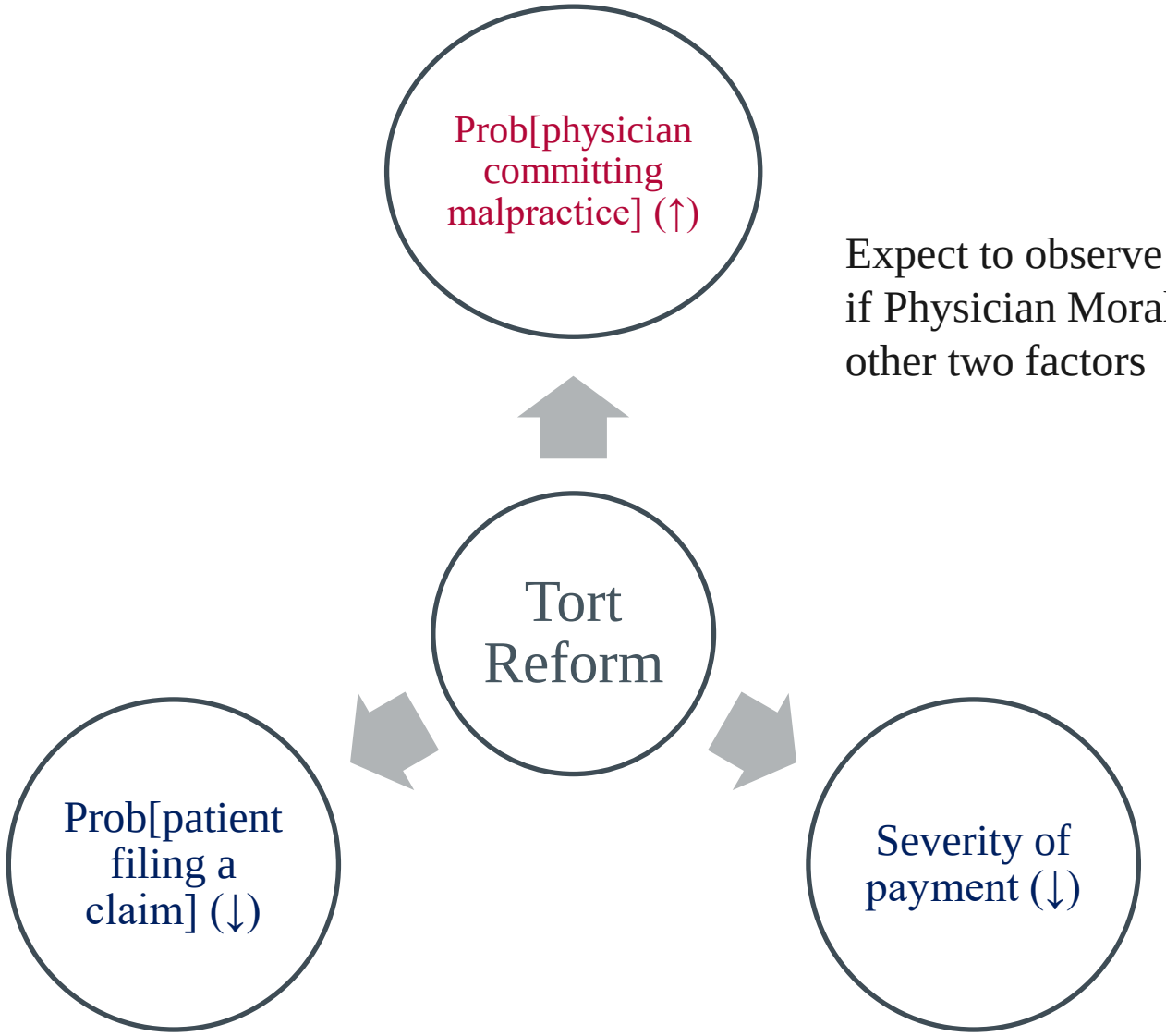
# Three-Factor Model




- **Positive Net LR Revisions**
- Decompose the effects of three factors (undone)

# Positive Net LR Revision




Expect to observe *positive net LR revisions* if Physician Moral Hazard dominates the other two factors

# Data

- Firm-level data
  - NAIC Property-Casualty Annual Statements, 1993-2015
- State-level data
  - Tort reform data
    - Database of State Tort Law Reforms (2012, DSTLR 5th)
    - 2017 American Tort Reform Association (ATRA) Tort Reform Record
  - State control variables: various sources
- Screening
  - Drop DPW <= 0, trim outliers at the 1% and 99% levels

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# Incurred Losses Prediction Method

- What are the loss reserves in absence of tort reform?
  - Predict future reserves using past information and actuarial model

- Idea of FIRR method (Grace and Leverty, 2017)
  - *Full Information Reserve Revision (FIRR)* = Reported Reserves (t) – Predicted Reserves (t)
  - Predicted Reserves (t) are made using data of year t-1 and **a forward-looking, regression-based model**
  - Around treatment year: FIRR is reserve revision after tort reform

Grace, Martin F. and Leverty, J. Tyler. (2017). External Monitor Quality and Managerial Discretion. Working paper, University of Wisconsin-Madison, WA.

# FIRR Method

- Regression (on year t-1 data)

$$\text{Log}(IncurredLosses)_{mn} = \alpha + \sum_{m=2}^{10} \lambda_m Row_m + \sum_{n=2}^{10} \delta_n Col_n + \varepsilon_{mn}$$

- Prediction (using year t data)

$$IncurredLosses_t = e^{\alpha + \lambda_m + \delta_{12-n}}$$

- Full Information Reserve Revision (FIRR)

$$\begin{aligned} FIRR_t &= ReportedIncurredLosses_t - IncurredLosses_t \\ &= \sum_{m=2}^{10} (ReportedIncurredLosses_{mt} - IncurredLosses_{mt}) \end{aligned}$$

# Example of FIRR

$$\text{Log}(IncurredLosses)_{mn} = \alpha + \sum_{m=2}^{10} \lambda_m Row_m + \sum_{n=2}^{10} \delta_n Col_n + \varepsilon_{mn}$$

**Medical Professional Mutual Insurance Company (NAIC Code = 10206)**

***Panel A: Reporting Year 1994***

| | | col1 | col2 | col3 | col4 | col5 | col6 | col7 | col8 | col9 | col10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Development Year | | | | | |
| | Accident Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| row1 | 1985 | 222135 | 197291 | 178868 | 155055 | 148120 | 135776 | 124453 | 116916 | 104418 | 101709 |
| row2 | 1986 | 212791 | 213042 | 168307 | 156990 | 134873 | 115985 | 105829 | 95486 | 91773 | $\alpha + \lambda_2 + \delta_{10}$ |
| row3 | 1987 | 271404 | 172330 | 177027 | 146324 | 120119 | 111173 | 94104 | 89484 | $\alpha + \lambda_3 + \delta_9$ | |
| row4 | 1988 | 183638 | 168941 | 154539 | 130901 | 122902 | 109151 | 101216 | $\alpha + \lambda_4 + \delta_8$ | | |
| row5 | 1989 | 196963 | 180051 | 153666 | 141629 | 121042 | 112140 | $\alpha + \lambda_5 + \delta_7$ | | | |
| row6 | 1990 | 196639 | 169779 | 153772 | 135711 | 120996 | $\alpha + \lambda_6 + \delta_6$ | | | | |
| row7 | 1991 | 173433 | 167964 | 160731 | 142990 | $\alpha + \lambda_7 + \delta_5$ | | | | | |
| row8 | 1992 | 190764 | 186226 | 147255 | $\alpha + \lambda_8 + \delta_4$ | | | | | | |
| row9 | 1993 | 194654 | 153910 | $\alpha + \lambda_9 + \delta_3$ | | | | | | | |
| row10 | 1994 | 163462 | $\alpha + \lambda_{10} + \delta_2$ | | | | | | | | |

***Panel B: Reporting Year 1995***

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Development Year | | | | | |
| | Accident Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | 1986 | 212791 | 213042 | 168307 | 156990 | 134873 | 115985 | 105829 | 95486 | 91773 | 84937 |
| | 1987 | 271404 | 172330 | 177027 | 146324 | 120119 | 111173 | 94104 | 89484 | 76401 | |
| | 1988 | 183638 | 168941 | 154539 | 130901 | 122902 | 109151 | 101216 | 90953 | | 34728 |
| | 1989 | 196963 | 180051 | 153666 | 141629 | 121042 | 112140 | 99575 | | 49354 | ***50209*** |
| | 1990 | 196639 | 169779 | 153772 | 135711 | 120996 | 102761 | | 48553 | ***27047*** | |
| | 1991 | 173433 | 167964 | 160731 | 142990 | 124264 | | 68616 | ***42400*** | | |
| | 1992 | 190764 | 186226 | 147255 | 136364 | | 83389 | ***30959*** | | | |
| | 1993 | 194654 | 153910 | 150357 | | 96151 | ***19372*** | | | | |
| | 1994 | 163462 | 162036 | | 116930 | ***28113*** | | | | | |
| | 1995 | 169988 | | 135902 | ***19434*** | | | | | | |
| | | | 153638 | ***14455*** | | | | | | | |
| | | | ***8398*** | | | | | | | | |

***Panel C: Summary***

| | | |
|---|---|---|
| incurred losses reported = | 1027648 | *(1995 data)* |
| incurred losses predicted = | 787260 | *(1994 data)* |
| ***FIRR*** = | ***240388*** | *1995 FIRR* |

# Allocate FIRR to State Level

- Pure sample
  - Medical malpractice insurers operating in only one state
  - 283 firms and 1,224 firm-year-state observations
  - 18% incurred losses and 17% direct premiums of full sample
  - *Biased toward small mutual insurers and RRGs*
- Full sample
  - All insurers, 497 firms and 50,580 firm-year-state observations
  - **Allocate *FIRR* to state level** using the proportion of premiums for each state
    - $FIRRst = FIRR * \%DPW_s$

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# Diff-in-Diff Model

- Two-way fixed effects DiD regression

$$FIRR(st)_{ist} = \sum_{j=1}^{5} \beta_j Reform_{j,st} + \alpha_t + \delta_s + \gamma_i + \boldsymbol{\lambda}\mathbf{X}_{it} + \boldsymbol{\eta}\mathbf{Z}_{st} + \varepsilon_{ist}$$

  - ***FIRR(st)*** is *FIRR* for the single-state sample or *FIRRst* for the full sample, both scaled by the average total admitted assets
  - ***Reform*** is a dummy for each of five types of tort forms
  - Physician moral hazard prevails if $\beta_j > 0$
    - Firm-level control variables ***X****:* managerial incentives for reserve management, firm size, group dummy, org form
    - State-level control variables ***Z****:* GSP per capita, personal healthcare expenditures, # of EEs of insurance carriers/hospitals, # of lawyers, average ratio of Republican in lower & upper house

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# Result of DiD Model

| Dependent Var = | Single-State Sample | | | Full Sample | | |
|---|---|---|---|---|---|---|
| | *FIRR_occ* | *FIRR_clm* | *FIRR_total* | *FIRRst_occ* | *FIRRst_clm* | *FIRRst_total* |
| **Tort Reform Variables** | | | | | | |
| *Caps on Noneconomic Damages* | -0.007 | 0.002 | -0.012 | -0.000 | -0.002*** | -0.002*** |
| | (0.013) | (0.014) | (0.017) | (0.000) | (0.000) | (0.000) |
| *Caps on Punitive Damages* | 0.005 | -0.011 | -0.022 | 0.000 | 0.001*** | 0.001** |
| | (0.011) | (0.029) | (0.017) | (0.000) | (0.000) | (0.000) |
| *Punitive Damage Evidence* | -0.020 | 0.074** | 0.046* | -0.000 | -0.001 | -0.001 |
| | (0.028) | (0.032) | (0.023) | (0.000) | (0.001) | (0.001) |
| *Collateral Source Rules* | -0.067 | 0.043 | -0.024 | -0.001 | -0.000 | -0.001 |
| | (0.054) | (0.033) | (0.032) | (0.001) | (0.001) | (0.002) |
| *Joint and Several Liability* | 0.005 | 0.019 | 0.016 | 0.000 | 0.003*** | 0.002** |
| | (0.009) | (0.015) | (0.017) | (0.000) | (0.001) | (0.001) |
| Observations | 809 | 1,068 | 1,224 | 38,287 | 45,317 | 50,544 |
| Overall R-squared | 0.649 | 0.574 | 0.576 | 0.434 | 0.282 | 0.322 |
| Fixed Effects | Firm, State, Year | Firm, State, Year | Firm, State, Year | Firm, State, Year | Firm, State, Year | Firm, State, Year |

*Note*: The table reports robust standard errors clustered by states in parentheses.

- Magnitude: 4.6% = $32.8 million, 0.1% = $2.8 million
- Why these reforms?
  - Punitive damages may unpredictably lead to a catastrophic jury verdict against the physicians.
  - Joint and several liability rules may also cause a significant liability

# Decomposition of LR Revision (future work)

- Partial derivatives

$$\begin{aligned}\Delta X &= \Delta F_D * F_{P0} * S_0 + \Delta F_P * F_{D0} * S_0 + \Delta S * F_{D0} * F_{P0} \\ &= (F_{D1} - F_{D0}) * F_{P0} * S_0 + (F_{P1} - F_{P0}) * F_{D0} * S_0 + (S_1 - S_0) * F_{D0} * F_{P0}\end{aligned}$$

- NPDB data
  - Medical malpractice payment records, 1993 to 2014
    - Patient (yearly average count) → $F_{P1}, F_{P0}$
    - Severity (yearly average payment) → $S_1, S_0$
  - Adverse action records, 1997 to 2018
    - Physician (yearly average count) → $F_{D1}, F_{D0}$

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# Conclusion & Contribution

- This paper investigates the prevalence of physician moral hazard after tort reform using medical malpractice insurers' reserve data.
- I find that physician moral hazard significantly exists after reforms to punitive damages and to joint and several liability rules.
- Contribution:
  - Provide the first empirical evidence of physician moral hazard due to tort reform
  - Add new evidence regarding the downside of tort reform

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# All comments are appreciated!

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THANK YOU VERY MUCH!

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