Optimality of no-fault medical liability systems

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Outline

- Introduction & brief literature
- Demand side cost sharing
  - third party vs. no fault – no fault optimal
  - partial liability – no fault optimal
  - elastic demand for health care
    - no fault optimal if there are enough instruments
    - if not, no fault optimal if demand not too elastic
- Supply side cost sharing
- Conclusion
Malpractice Liability

- General idea of liability regimes is to ensure that agents have sufficient incentives to “take care”
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  - Counties with higher malpractice liability pressure have higher cesarean rates (Dubay et al, 1999)
  - Spend more on treating heart disease patients with no effect on outcomes (Kessler and McClellan, 1996)
No Fault liability

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- Patients get compensated by taxpayers for accidents
- Doctors face no liability at all
- In general, this would lead to too little “defensive medicine”
- Doctors will order too few tests etc.
- New Zealand and Sweden are happy with their systems with no intention to reform whereas US has pressure for malpractice reform
Our Paper

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- Effect of third-party liability regimes is to increase cost sharing or supply side incentives
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Show that under some conditions no fault liability is optimal
In reality defensive medicine is subsidised by the insurer

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Show that under some conditions no fault liability is optimal

Insurance is a better instrument than liability
Danzon (1985): effect of health insurance on doctor’s choice of tests versus effort in reducing accidents
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Currie and MacLeod (2008) show that third-party liability affects procedure choice
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Currie and MacLeod (2008) show that third-party liability affects procedure choice

No paper considers the problem of joint optimality of liability regime and insurance
The Basic Model: Agents

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Introduction

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- patient faces risk of falling ill ($\pi$) and then has to be treated by a doctor
  - Upon falling ill, has probability $p [d]$ of facing treatment related accident
- doctor provides treatment
**The Basic Model**

We compare two regimes

1. In regime ∅ the NHI pays the patient the costs from a treatment related accident
The Basic Model

We compare two regimes

1. In regime $\emptyset$ the NHI pays the patient the costs from a treatment related accident
2. In regime $III$ the doctor pays the patient
NHI provides taxpayer funded health insurance to maximise consumer *ex ante* welfare choosing health care copayment $\theta$. 

Thrid party vs. no fault

**Timing**

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3. Nature moves and patient falls ill with probability $\pi$, patient visits the doctor.


Timing

1. NHI provides taxpayer funded health insurance to maximise consumer \( \text{ex ante} \) welfare choosing health care copayment \( \theta \).

2. Tax rate \( (R) \) is set to satisfy the NHI budget constraint.

3. Nature moves and patient falls ill with probability \( \pi \), patient visits the doctor.

4. Wage rate \( (Y) \) for the doctor is paid by NHI to provide doctor his reservation utility \( \overline{U}^d \).
Thrid party vs. no fault

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2. Tax rate ($R$) is set to satisfy the NHI budget constraint.
3. Nature moves and patient falls ill with probability $\pi$, patient visits the doctor.
4. Wage rate ($Y$) for the doctor is paid by NHI to provide doctor his reservation utility $\bar{U}^d$.
5. Doctor delivers fixed curative care $h$ using effort $E$ and chooses quantity of preventive care $(d)$. 
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6. Patient pays $h\theta$ for $h$ and $\theta d$ for defensive medicine.
Timing

1. NHI provides taxpayer funded health insurance to maximise consumer ex ante welfare choosing health care copayment $\theta$.
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3. Nature moves and patient falls ill with probability $\pi$, patient visits the doctor.
4. Wage rate ($Y$) for the doctor is paid by NHI to provide doctor his reservation utility $\overline{U}^d$.
5. Doctor delivers fixed curative care $h$ using effort $E$ and chooses quantity of preventive care ($d$).
6. Patient pays $h\theta$ for $h$ and $\theta d$ for defensive medicine.
7. A treatment related accident occurs with probability $p[d]$ and the Government (doctor) pays the patient $L$ in the $\emptyset (III)$ regime.
The Model: Consumer’s utility

- ex-ante utility

\[ \Psi_i = (1 - \pi) V [W - R_i] + \pi U^p_i \]

- where \( i \in \{\phi, III\} \)
Ex post utility

\[ U^p = V \left[ W - H - R + (1 - \theta) h - \theta d \right] - p [d] (z + L), \]

- \( V [.] \) - utility function
- \( W - H \) - income after the health loss
- \( h \) - curative care; health improvement
- \( d \) - preventive care ("defensive medicine")
- \( \theta \) - copayment ratio
- \( R \) - the tax rate
- \( p [d] \) - probability of a treatment related accident effect \((p' < 0, p(\overline{d}) = p, p(0) = \overline{p})\)
- \( z \) - uninsurable loss
- \( L \) - insurable loss
Preferences: Doctor

- Cares about the patient’s health and out of pocket costs as well as his own income

\[
U^d_{III} = Y_{III} - E - p[d] L + \\
\beta (V [W - H + (1 - \theta) h - \theta d] - p [d] z)
\]

\[
U^d_\emptyset = Y_\emptyset - E + \\
\beta (V [W - H + (1 - \theta) h - \theta d] - p [d] z)
\]

assume \(0 < \beta < 1\)
Preferences: Doctor

- $E$ is the fixed effort of providing $h$
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- $E$ is the fixed effort of providing $h$
- $Y_i$ is set by the NHI to yield doctor his reservation utility of $\bar{U}^d$
Preferences: Doctor

- $E$ is the fixed effort of providing $h$
- $Y_i$ is set by the NHI to yield doctor his reservation utility of $\bar{U}^d$
- $Y_\emptyset < Y_{III}$
Since doctor’s utility is fixed at $U_d$, maximising welfare is equivalent to maximising $\Psi$. 

Preferences: NHI
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- Since doctor’s utility is fixed at $\bar{U}^d$, maximising welfare is equivalent to maximising $\Psi$
- NHI’s budget constraint:

$$R_{III} = \pi \left((1 - \theta) (h + d) + Y_{III}\right)$$

and

$$R_\emptyset = \pi \left((1 - \theta) (h + d) + p [d] L + Y_\emptyset\right).$$
Demand for defensive medicine

- $d[\theta]$ is the doctor’s optimal $d$ in response to a patient facing $\theta$
- Depends on the regime

$$d_{III} [\theta] = \arg \max_d \left[ -p[d] L + \beta \tilde{U}^p \right]$$

$$d_{\emptyset} [\theta] = \arg \max_d \beta \tilde{U}^p$$  \hspace{1cm} (1)
Under both regimes, patient receives $L$ in the event of a treatment related loss.
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- In regime III, the doctor has to be compensated for facing a higher liability risk so $Y_{III} > Y_{Ø}$

\[
Y_{III} = \bar{U}^d + E + p[d_{III}(\theta)]L + \beta\tilde{U}_{III}^p \\
Y_{Ø} = \bar{U}^d + E + \beta\tilde{U}_{Ø}^p
\]
Under both regimes, patient receives $L$ in the event of a treatment related loss.

In regime $III$, the doctor has to be compensated for facing a higher liability risk so $Y_{III} > Y_{\emptyset}$

$$Y_{III} = \bar{U}^d + E + p \left[ d_{III} (\theta) \right] L + \beta \tilde{U}_{III}^p$$

$$Y_{\emptyset} = \bar{U}^d + E + \beta \tilde{U}_{\emptyset}^p$$

This increased $Y$ is paid for through higher $R$. 
Under both regimes, patient receives $L$ in the event of a treatment related loss.

In regime $III$, the doctor has to be compensated for facing a higher liability risk so $Y_{III} > Y_{∅}$

\[
Y_{III} = \bar{U}^d + E + p \left[ d_{III} (θ) \right] L + β \bar{U}_{III}^p
\]
\[
Y_{∅} = \bar{U}^d + E + β \bar{U}_∅^p
\]

This increased $Y$ is paid for through higher $R$.

In both regimes taxpayer eventually pays for $L$ (either through higher $Y$ or directly).
Under both regimes, patient receives $L$ in the event of a treatment related loss.

In regime $III$, the doctor has to be compensated for facing a higher liability risk so $Y_{III} > Y_∅$

$$Y_{III} = \bar{U}^d + E + p[d_{III}(\theta)]L + \beta U^p_{III}$$
$$Y_∅ = \bar{U}^d + E + \beta U^p_∅$$

This increased $Y$ is paid for through higher $R$.

In both regimes taxpayer eventually pays for $L$ (either through higher $Y$ or directly).

*Therefore, only difference is that regime $III$ yields higher $d$ for a given $\theta$.**
Third party vs. no fault

Figure: Best Response $d(\theta)$
Consider a third-party liability system and the optimal $\tilde{\theta}$ which maximises welfare and implements some $\tilde{d}$.
Optimality of no-fault

- Consider a third-party liability system and the optimal $\tilde{\theta}$ which maximises welfare and implements some $\tilde{d}$
- There exists a $\theta^* < \tilde{\theta}$ which implements $\tilde{d}$ under no-fault
Ex post utility

Compare ex post utility under regimes $III$ with $∅$

$$U^P_{III} = V \left[ W - H + h - \tilde{\theta} \left( h + \tilde{d} \right) - R_{III} \right] - p \left[ \tilde{d} \right] z$$

$$U^P_∅ = V \left[ W - H + h - \theta^* \left( h + \tilde{d} \right) - R_∅ \right] - p \left[ \tilde{d} \right] z$$

Regime $∅$ provides more insurance since consumer gets $\left( \tilde{\theta} - \theta^* \right) \left( h + \tilde{d} \right)$ more in the event of falling ill
Introduction

Demand side cost sharing

Supply side cost sharing

Conclusion

Third party vs. no fault

Tax rates

Compare taxes under regimes III with ∅

\[ R_{III} = \pi \left( 1 - \tilde{\theta} \right) \left( h + \tilde{d} \right) + \pi Y_{III} \]

\[ = \pi \left( 1 - \tilde{\theta} \right) \left( h + \tilde{d} \right) + \pi U^d + \pi E + \pi p \left( \tilde{d} \right) L \]

\[ - \pi \beta \left( V \left[ W - H + \left( 1 - \tilde{\theta} \right) h - \tilde{\theta} \tilde{d} \right] - p \left[ \tilde{d} \right] z \right) \]

\[ R_∅ = \pi \left( 1 - \theta^* \right) \left( h + \tilde{d} \right) + \pi p \left[ \tilde{d} \right] L + \pi Y_∅ \]

\[ = \pi \left( 1 - \theta^* \right) \left( h + \tilde{d} \right) + \pi p \left[ \tilde{d} \right] L + \pi U^d + \pi E \]

\[ - \pi \beta \left( V \left[ W - H + \left( 1 - \theta^* \right) h - \theta^* \tilde{d} \right] - p \left[ \tilde{d} \right] z \right) \]
\[ R_{\emptyset} - R_{\text{III}} = \pi \left( \tilde{\theta} - \theta^* \right) \left( h + \tilde{d} \right) - \pi \epsilon \]

where

\[ \epsilon = \beta \left( V \left[ W - H + (1 - \theta^*) h - \theta^* \tilde{d} \right] - V \left[ W - H + \left( 1 - \tilde{\theta} \right) h - \tilde{\theta} \tilde{d} \right] \right) \]

Regime III costs more since consumer has to pay \( \pi \left( \tilde{\theta} - \theta^* \right) \left( h + \tilde{d} \right) - \epsilon \) more
No Fault Insurance optimal

- Ex-ante utility is higher under ∅ and θ∗
No Fault Insurance optimal

- Ex-ante utility is higher under $\mathcal{O}$ and $\theta^*$
- Since consumers are risk averse, they would be willing to pay a fair price to transfer wealth from well state to sick
Ex-ante utility is higher under $\emptyset$ and $\theta^*$

Since consumers are risk averse, they would be willing to pay a fair price to transfer wealth from well state to sick

But, only has to pay $\left(\tilde{\theta}_{III} - \tilde{\theta}_{\emptyset}\right) \left(h + \tilde{d}\right) - \pi \varepsilon$
No Fault Insurance optimal

- Ex-ante utility is higher under $\emptyset$ and $\theta^*$
- Since consumers are risk averse, they would be willing to pay a fair price to transfer wealth from well state to sick
- But, only has to pay $\left(\widetilde{\theta}_{III} - \widetilde{\theta}_{\emptyset}\right)\left(h + \widetilde{d}\right) - \pi \varepsilon$
- Therefore, welfare is higher under regime $\emptyset$ than under $III$
General liability regime

- timing of the game is identical to that above but this time at stage 1, the NHI chooses $\alpha$ (and $\theta$).

**Theorem**

A no-fault system ($\alpha = 0$) is optimal.
Partial liability

General liability regime

- Timing of the game is identical to that above but this time at stage 1, the NHI chooses $\alpha$ (and $\theta$).
- $\alpha$ determines the share of liability imposed on the doctor

Theorem

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Partial liability

General liability regime

- timing of the game is identical to that above but this time at stage 1, the NHI *chooses* $\alpha$ (and $\theta$).
- $\alpha$ determines the share of liability imposed on the doctor
- doctor pays $\alpha L$ and NHI pays $(1 - \alpha) L$ in the event of an accident

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*A no-fault system* ($\alpha = 0$) *is optimal.*
General liability regime

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- $\alpha = 0$ corresponds to the no-fault regime

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General liability regime

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- $\alpha$ determines the share of liability imposed on the doctor
- doctor pays $\alpha L$ and NHI pays $(1 - \alpha) L$ in the event of an accident
- $\alpha = 0$ corresponds to the no-fault regime
- $\alpha = 1$: third party

**Theorem**

A no-fault system ($\alpha = 0$) is optimal.
Suppose there is moral hazard effects on $h$ and $d$. 

Lower $\theta$ leads to higher $h$ and $d$. Then is it always optimal to have $\alpha = 0$? However, if the social planner can set different copayment ratio for $h$ and $d$, $\alpha = 0$ is still optimal.
Elasticity in Demand for $h$

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- Suppose there is moral hazard effects on \( h \) and \( d \)
- Lower \( \theta \) leads to higher \( h \) and \( d \)
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- depends on the elasticity of demand for \( h \)
Elasticity in Demand for $h$

- Suppose there is moral hazard effects on $h$ and $d$
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- then is it always optimal to have $\alpha = 0$?
- depends on the elasticity of demand for $h$
- However, if the social planner can set different copayment ratio for $h$ and $d$, $\alpha = 0$ is still optimal
Optimal Defensive Medicine

- Define $d^1$ as the level chosen by a fully informed and uninsured consumer who faces the full liability of the iatrogenic effect.
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$d^1$ (the first best level) is where

$$-p'[d] (L + z) = V' [W - H - d]$$
Patient Uninsured, Doctor Fully Liable

\[ \theta = 1, \text{ and } \alpha = 1. \text{ In this case the doctor's choice of } d \text{ satisfies} \]

\[ -p'[d] (L + \beta z) = \beta V' [W - H - d] \]
Patient Uninsured, Doctor Fully Liable

- $\theta = 1$, and $\alpha = 1$. In this case the doctor’s choice of $d$ satisfies

$$-p'[d] (L + \beta z) = \beta V' [W - H - d]$$

- For $\beta = 1$, $d = d^1$. For $\beta < 1$, the choice of $d$

$$-p'[d] (L + \beta z) = \frac{\beta}{\beta} V' [W - H - d]$$

and since

$$-p'[d] (L + z) > \frac{-p'[d] (L + \beta z)}{\beta}$$

$$d > d^1.$$
Patient Uninsured, Doctor Fully Liable

- $\theta = 1$, and $\alpha = 1$. In this case the doctor’s choice of $d$ satisfies
  \[-p'[d](L + \beta z) = \beta V'[W - H - d]\]

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  \[\frac{-p'[d](L + \beta z)}{\beta} = V'[W - H - d]\]

  and since
  \[-p'[d](L + z) > \frac{-p'[d](L + \beta z)}{\beta}\]

  $d > d^1$.

- *There is too much preventive medicine, since the doctor over-weights his own liability compared to the cost faced by the patient.*
Patient Uninsured, No-Fault Liability

$\theta = 1$ and $\alpha = 0$. In this case, the doctor’s choice of $d$ satisfies

$$-p'[d](\beta z) = \beta V'[W - H - d],$$

and we have $d < d^1$.  

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\( \theta = 1 \) and \( \alpha = 0 \). In this case, the doctor’s choice of \( d \) satisfies

\[
-p'[d](\beta z) = \beta V'[W - H - d],
\]

and we have \( d < d^1 \).

- There is too little preventive medicine, since the doctor ignores the accident loss \( L \).
Patient Fully Insured, Doctor Fully Liable

- $\theta = 0$ and $\alpha = 1$. In this case the doctor’s choice of $d$ satisfies

$$-p'(d)(L + \beta z) = 0.$$
Patient Fully Insured, Doctor Fully Liable

- $\theta = 0$ and $\alpha = 1$. In this case the doctor’s choice of $d$ satisfies
  
  $$-p'(d)(L + \beta z) = 0.$$  

- For $\theta = 0$, we have $d = \bar{d} > d^1$. 

Patient Fully Insured, Doctor Fully Liable

- $\theta = 0$ and $\alpha = 1$. In this case the doctor’s choice of $d$ satisfies
  \[-p'(d) (L + \beta z) = 0.\]

- For $\theta = 0$, we have $d = \bar{d} > d^1$.

- *There is too much preventive medicine, since the doctor over-weights his own liability and patients face no costs.*
\( \theta = 0 \) and \( \alpha = 0 \). In this case the doctor's choice of \( d \) satisfies

\[-p'(d)(\beta z) = 0.\]
\[ \theta = 0 \text{ and } \alpha = 0. \text{ In this case the doctor's choice of } d \text{ satisfies} \]
\[ -p'(d) (\beta z) = 0. \]

- We again have \( d = \tilde{d} > d^1 \).
Patient Fully Insured, No-Fault Liability

- $\theta = 0$ and $\alpha = 0$. In this case the doctor's choice of $d$ satisfies
  
  \[-p'(d) (\beta z) = 0.\]

- We again have $d = \bar{d} > d^1$.

- There is too much preventive medicine, since the patients face no costs.
Summary

<table>
<thead>
<tr>
<th></th>
<th>$\alpha = 0$</th>
<th>$\alpha = 1$</th>
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<tbody>
<tr>
<td>$\theta = 0$</td>
<td>$d = \bar{d} &gt; d^1$</td>
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</tr>
<tr>
<td>$\theta = 1$</td>
<td>$d &lt; d^1$</td>
<td>$d &gt; d^1$</td>
</tr>
</tbody>
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Table: Summary of optimal $d$ versus the doctor’s choice.
Supply-Side Cost Sharing

- Suppose patient is fully insured but doctor faces supply-side cost sharing

\[ U^d = Y - E - p[d] \alpha L - cd + \beta \tilde{U}^p. \]
Supply-Side Cost Sharing

- Suppose patient is fully insured but doctor faces supply-side cost sharing

\[ U^d = Y - E - p [d] \alpha L - cd + \beta \tilde{U}^p. \]

- In this case, both \( c \) and \( \alpha \) are policy instruments for the NHI to implement \( d \)
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- In this case, both \( c \) and \( \alpha \) are policy instruments for the NHI to implement \( d \)
- We show that since doctor is risk neutral – \( \alpha \) and \( c \) are substitutes
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\[ U^d = Y - E - p[d] \alpha L - cd + \beta \tilde{U}^p. \]

In this case, both \( c \) and \( \alpha \) are policy instruments for the NHI to implement \( d \)

We show that since doctor is risk neutral – \( \alpha \) and \( c \) are substitutes

Confirms Kesler and McLellan (2002)’s view: Managed care which imposed supply side cost sharing for tests had the same effect as malpractice reform in lowering defensive medicine.
Conclusion

- There are off-setting effects between liability regime and insurance regime
- Optimal liability regime has to take into account the effect on $\theta$
- Third party liability makes it harder to provide more insurance
- If there are enough instruments or if the moral hazard problem on curative care is not too serious, no fault systems are optimal