Excess Verdicts Insurance

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Contents

Introduction to Excess Verdicts

- **Excess Verdicts (EVs)** aka "nuclear verdicts": court-awarded damages far exceeding policy limits, often in cases like wrongful death or personal injury
- Unlike operational risks, EVs stem from **unpredictable legal decisions**, showing the limits of traditional risk models
- **Evolving Legal Factors:** *bad faith* and *negligence* can impact jury and judge decisions, increasing uncertainty and legal risks for insurers
- EVs lead to unexpected financial pressures, high legal costs for both policyholders and insurers, and compensation delays for injury party

Contribution

- Study a **multi-environment** optimal insurance problem
  - optimal contract is **layer-type** (deductible and upper limit) in each environment
  - deductible is environment independent
- Application: ex-ante agreement in case of EV

Ex Ante Agreements and Predictive Mechanisms

Ex Ante Agreements:

Defines insurer and policyholder responsibilities in advance to reduce disputes and clarify financial distribution in excess verdict cases.

Stage 1: Policy Limit Check

- **Trigger:** Court-awarded damages exceed policy limits.
- **Action:** Initiates Stage 2 review.

Ex Ante Agreements and Predictive Mechanisms

Stage 2: Insurer Conduct Review

- **Trigger:** Review of insurer's actions for good or bad faith.
- **Good Faith:** Insurer acts fairly and thoroughly, aiming to settle within limits.
- **Bad Faith:** Unreasonable actions like delaying claims or unfairly rejecting settlements.
- **Outcome:** Financial responsibility is allocated based on the insurer's conduct.

Comparing Buyer and Seller Payments in EV Contracts

Contract Payments With vs. Without Environment-Contingent Provisions

- **Goal:** Compare payments under contracts **with and without environment-contingent provisions** under EVs
- **Scenarios:**
  - **Y=1:** Damages within policy limits (no excess)
  - **Y=2:** Damages exceed limits, no insurer bad faith
  - **Y=3:** Excess verdict with insurer bad faith

Comparing Buyer and Seller Payments in EV Contracts

Scenario	Party	Without Provisions	With Provisions
Y=1	Buyer	$\hat{R}(X)$	$R_1(X)$
	Seller	$\hat{I}(X)$	$I_1(X)$
Y=2	Buyer	$\hat{R}(L) + (X - L)$	$R_2(L) + (X - L)$
	Seller	$\hat{I}(L)$	$I_2(L)$
Y=3	Buyer	$\hat{R}^c(X)$	$R_3(\tilde{L}) + (X - \tilde{L})_+$
	Seller	$\hat{I}^c(X)$	$I_3(X) = X - R_3(\tilde{L}) - (X - \tilde{L})_+$

Multiple Indemnity Environments

Problem Setting

- **Setup:** one-period economy and risk sharing between buyer and seller; risk $X \geq 0$
- **Risk Environments:** exogenous environment Y partitions the sample space into $m+1$ disjoint subsets;
  if $Y = k$, buyer transfers $I_k(X)$ to seller,
  retains $R_k(X) = X - I_k(X)$
- **Admissible profiles:**

$$\mathcal{I} := \{\mathbf{I} = (I_1, \ldots, I_m) : 0 \leq I_k \leq \mathrm{Id}, \\ I_k \text{ and } R_k \text{ non-decreasing for all } k = 1, \ldots, m\}.$$

Multiple Indemnity Environments

Problem Setting

- **Premium paid to seller:** Wang's premium principle, g (nondecreasing, concave) distortion function, $Z \geq 0$ risk

$$P_g\left(Z\right) = \int_0^{\infty} g\left(S_Z(z)\right) \mathrm{d}z$$

- **Buyer's Risk Positions:** $\rho \geq 0$ loading rate

$$\mathbf{B}(\mathbf{I}) := \sum_{k=1}^{m} R_k(X) 1_{\{Y=k\}} + (1+\rho) P_g\left(\sum_{k=1}^{m} I_k\left(X\right) 1_{\{Y=k\}}\right)$$

Multiple Indemnity Environments (cont'd)

Problem Setting

- **Buyer's Risk Measure:** φ translation invariant, monotonic

$$\begin{aligned} F_{\varphi}(\mathbf{I}) &= \varphi(\mathbf{B}(\mathbf{I})) \\ &= \varphi\left(\sum_{k=1}^{m} R_k(X)\mathbf{1}_{\{Y=k\}}\right) + (1+\rho)P_g\left(\sum_{k=1}^{m} I_k(X)\,\mathbf{1}_{\{Y=k\}}\right) \end{aligned}$$

Buyer's problem

$$\inf_{\mathbf{I}\in\mathcal{I}} F_{\varphi}(\mathbf{I})$$

solution to this problem is Pareto efficient!

Multiple Indemnity Environments (cont'd)

Problem Setting

- **Subset of admissible indemnity profiles:**

$$\mathcal{I}^* = \Big\{ \mathbf{I} \in \mathcal{I} \colon \text{for each } k = 1, \ldots, m, \\ I_k(x) = (x - d_k)_+ - (x - l_k)_+ \text{ for some } d_k \leq l_k \Big\}$$

Each indemnity profile in $\mathcal{I}^*$ features layer-type transfers where, in any exogenous environment, the indemnity is full insurance beyond a deductible d_k and up to an upper limit l_k

Main Theorem

Main Theorem

Let $\varphi = \mathrm{VaR}_\alpha$ or $\varphi = \mathrm{CVaR}_\alpha$. For any $\rho \geq 0$ and $\mathbf{I} \in \mathcal{I}$, there exists $\tilde{\mathbf{I}} \in \mathcal{I}^*$ st

$$F_\varphi(\tilde{\mathbf{I}}) \leq F_\varphi(\mathbf{I})$$

Corollary (1)

$\tilde{\mathbf{I}} = (\tilde{I}_1, \ldots, \tilde{I}_m)$ can be chosen so that the deductible in each environment coincide

$$d_1 = \cdots = d_k = d$$

Corollary (2)

$F_\varphi(\tilde{\mathbf{I}}) < F_\varphi(\mathbf{I})$ if $\mathbf{I} \notin \mathcal{I}^*$

Extension

Main Theorem

The Theorem still holds if the buyer's risk position is

$$\mathbf{B}(\mathbf{I}) := \sum_{k=1}^{m} R_k(X)1_{\{Y=k\}} + \sum_{k=1}^{m} P_{g_k}\left(I_k\,(X)\,1_{\{Y=k\}}\right)$$

a different distortion function in each environment to obtain the premium
Special case of interest is the **proportional hazard transform (PH)**:
$g_k(z) = z^{\beta_k}$, $0 < \beta_k \leq 1$

Simulation Study

Setting

- $m = 3$ risk environments; $(X|Y = k) \sim$ type II Pareto for all k

k	$\mathbb{P}(Y = k)$	λ	α	$\mathbb{E}[X|Y = k]$	$SD[X|Y = k]$
1	60%	40	5	10	12.91
2	30%	200	3	100	173.21
3	10%	1,500	2.5	1,000	2236.07

- Risk increases from scenario 1 to 3; scenario 3 $\equiv$ excess verdicts
- Use $\varphi = \text{CVaR}_{95\%}$. To adjust premiums for large losses, we use the proportional hazard transform with distortion function $g(z) = z^{\beta_k}$

Simulation Results (1/3)

	Risk environment Y_1		Risk environment Y_2		Risk environment Y_3	
β_1	$F_X(d)$	$S_X(l_1)$	$F_X(d)$	$S_X(l_2)$	$F_X(d)$	$S_X(l_3)$
0.45	93.13%	0.72%	32.80%	0.43%	4.57%	4.31%
0.55	89.44%	0.21%	27.58%	0.43%	3.69%	4.31%
0.65	85.40%	0.03%	23.60%	0.43%	3.06%	4.31%
0.75	81.19%	0.00%	20.48%	0.43%	2.60%	4.31%
0.85	76.93%	0.00%	17.95%	0.43%	2.24%	4.31%
0.95	72.71%	0.00%	15.87%	0.43%	1.95%	4.31%

Table: CDF at the deductible and survival function at the upper limit, conditional on each scenario, for different values of β_1.

Simulation Results (3/3)

	Risk environment Y_1		Risk environment Y_2		Risk environment Y_3	
β_2	$F_X(d)$	$S_X(l_1)$	$F_X(d)$	$S_X(l_2)$	$F_X(d)$	$S_X(l_3)$
0.45	90.69%	0.032%	29.12%	1.44%	3.94%	4.31%
0.55	85.40%	0.032%	23.60%	0.43%	3.06%	4.31%
0.65	79.93%	0.032%	19.67%	0.06%	2.48%	4.31%
0.75	74.51%	0.032%	16.72%	0.00%	2.07%	4.31%
0.85	69.28%	0.000%	14.41%	0.00%	1.75%	4.31%
0.95	64.32%	0.000%	12.57%	0.00%	1.51%	4.31%

Table: CDF at the deductible and survival function at the upper limit, conditional on each scenario, for different values of β_2.

Simulation Results (3/3)

	Risk environment Y_1		Risk environment Y_2		Risk environment Y_3	
β_3	$F_X(d)$	$S_X(l_1)$	$F_X(d)$	$S_X(l_2)$	$F_X(d)$	$S_X(l_3)$
0.45	85.40%	0.032%	23.60%	0.43%	3.06%	4.31%
0.55	78.72%	0.032%	18.95%	0.43%	2.38%	1.28%
0.65	72.53%	0.000%	15.80%	0.43%	1.94%	0.19%
0.75	67.09%	0.000%	13.56%	0.43%	1.64%	0.006%
0.85	62.45%	0.000%	11.94%	0.43%	1.43%	0.00002%
0.95	58.57%	0.000%	10.73%	0.43%	1.27%	0.00%

Table: CDF at the deductible and survival function at the upper limit, conditional on each scenario, for different values of β_3.

Thank you for your attention!