Information Asymmetry in Cyber Insurance Markets

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October 19, 2024, Zurich

Opinion **US**

The ransomware battle is shifting — so should our response

Billions of dollars are being lost each year and critical infrastructure is coming under threat

ANNE NEUBERGER + Add to myFT

Introduction and Theoretical Framework

- **Motivation:**
  - Rising frequency and severity of cyber incidents (e.g., WannaCry, NotPetya).
  - Economic losses from cyber risks estimated in trillions of USD annually.
  - Significant protection gap: 90% of losses remain uninsured.
- **Objective:**
  - Investigate information asymmetry in the U.S. cyber insurance market.
  - Focus on adverse selection (hidden information) and moral hazard (hidden actions).
- **Theoretical Model:**
  - Monopolistic insurer with partial information on firm risk levels.
  - Firms classified as high or low risk based on imperfect signals.
  - Model predictions:
    1. High-risk firms are more likely to purchase insurance.
    2. High-risk firms face higher prices.
    3. High-risk firms face lower coverage post-insurance.
    4. Risk increases after insurance purchase.

Summary of Findings (1/2)

- Correlation between cyber security measures and incidents:
  - Independent risk scores (Score A and Score B) are significantly correlated with actual cyber incidents.
  - Survey-based score is not correlated with actual incidents, suggesting it provides limited information for insurers.
- High-risk firms more likely to purchase insurance
  - Only when using Score A and Score B.
  - When using survey score, opposite result.
  - Adverse selection driven by imperfect risk scores
- Lower coverage for high-risk firms
  - High-risk firms tend to receive lower coverage due to concerns over moral hazard.

Summary of Findings (2/2)

- No significant increase in cyber risk post insurance
  - The study finds no significant change in risk scores for firms after purchasing insurance.
  - Suggests limited evidence for moral hazard in post-insurance behavior.
- Propensity score matching analysis and staggered diff-in-diff
  - After matching similar firms (insured vs. uninsured), their cybersecurity scores appear similar over time.

My Comments

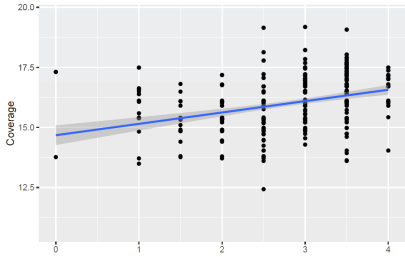
- The model
- Adverse selection
- Post-insurance activity
- Joint explanation of the adverse selection and moral hazard
- Minor comments

More Cyber-Specific Features

- Model follows standard contract theory (adverse selection, moral hazard).
- Some predictions align with general insurance theory, applicable to any risk (e.g., health, employment).
- Cyber risk has unique characteristics:
  - Active and potentially long-lasting cybersecurity investments by firms.
  - Use of third-party risk scores for classification.
- Suggestion: reflect more unique dynamics.

Adverse Selection

- Firms with high Score A/B are less likely to purchase cyber insurance; But firms with high survey scores are more likely to purchase cyber insurance.
  $\Rightarrow$ Insurers attempt to select low-risk firms but fail to recognize
- But for the coverage ratio, it seems insurers can recognize low-risk firms and assign a higher coverage ratio?
- Is it possible that the insurance decision not only depends on the cyber risk? If a firm is high-risk, insurer can still break even by charging a high premium.



(a) Coverage ratio and survey score

Table 8: Cybersecurity scores and insurance coverage

Dependent Variable:	Coverage ratio (%)			
Model:	(1)	(2)	(3)	(4)
Security score A	0.0303***	0.0237**		
	(0.0089)	(0.0099)		
Security score B			0.1536**	0.1544**
			(0.0639)	(0.0667)
Controls	N	Y	N	Y
Year FE	N	Y	N	Y
Observations	487	487	610	610
R^2	0.02805	0.26407	0.01358	0.23798

(b) Coverage ratio and score A/B

Post-insurance Activity

- Main finding is: the cybersecurity scores do not exhibit a significant difference between firms that purchase insurance and those that do not, for up to five years following the purchase.
- Another possible reason: the insurance contract is effectively designed to mitigate such behavior.
- Suggestion:
  - Control for contractual elements, e.g., deductibles, or requirements for maintaining specific cybersecurity standards
  - Incorporate these factors in the modeling

Joint explanation

- Ex ante finding: Before purchasing insurance, the data shows that higher-risk firms are more likely to buy insurance. This finding suggests that adverse selection is present, as firms that perceive themselves as high-risk are more inclined to get coverage.
- Ex post finding: After using propensity score matching (PSM) to find comparable firms, the results indicate that firms with and without insurance have similar risk scores over time. This suggests there isn't much difference in cybersecurity posture between insured and uninsured firms after controlling for observable characteristics.
- Suggestion: A more detailed discussion on these findings, explore other factors.

Minor Comments

- Maybe standardize Score A and B, such that the correlation plot is more intuitive
- More clarification on model assumptions
- Further breakdown of risk categories: not only risk, but also firm-size
- Page 19: "...based on survey scores show that firms with lower score receive higher coverage."

Conclusion

- An interesting paper on an understudied and important topic
- Novel dataset with rich empirical results
- More investigations into the mechanisms for better implications
- I learned a lot and look forward to the next version!