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# Excluded Losses and the Demand for Insurance 

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## Small Losses

## Independent Losses

## Excluded Losses

# Homeowner's Insurance: damage due to flood 

Life insurance: death due to suicide

Product warranty: damage caused by tampering

Crop insurance: "not following good agricultural practices"

## Two properties

1. unreimbursed
2. When an excluded loss occurs, a covered loss does not occur, and vice versa

Let $x_{1}$ denoted a cover loss and $x_{2}$ an excluded loss

$$
\begin{aligned}
& \alpha \cdot f_{1}(x) \text { for }\left(x_{1}, x_{2}\right)=(x, 0) \text { for all } x \text { in }[0, b] \\
& g\left(x_{1}, x_{2}\right)=\quad(1-\alpha) \cdot f_{2}(x) \text { for }\left(x_{1}, x_{2}\right)=(0, x) \text { for all } x \text { in }[0, b]
\end{aligned}
$$

$$
0 \text { for }\left(x_{1}, x_{2}\right)=\text { all other values in }[0, b] \times[0, b]
$$

$$
g\left(x_{1}, x_{2}\right)=h_{1}\left(x_{1}\right) \cdot h_{2}\left(x_{2}\right)
$$



$$
\mathrm{W}=\mathrm{W}_{0}+\mathrm{V}-\mathrm{x}_{1}+\theta\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right)
$$

$$
\mathrm{Eu}(\mathrm{~W})=\int_{0}^{\mathrm{b}} \mathrm{u}\left(\mathrm{~W}_{0}+\mathrm{V}-\mathrm{x}_{1}+\theta\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right)\right) \mathrm{f}_{1}\left(\mathrm{x}_{1}\right) \mathrm{d} \mathrm{x}_{1}
$$

$$
\mathrm{W}=\mathrm{W}_{0}+\mathrm{V}-\mathrm{x}_{1}-\mathrm{x}_{2}+\theta\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right)
$$

$E u(W)=\iint_{0 \leq x_{1} \leq b, x_{2}=0} u\left(W+V-x_{1}-x_{2}+\theta\left(I\left(x_{1}\right)-P\right)\right) g\left(x_{1}, x_{2}\right)$

$$
+\iint_{0 \leq x_{2} \leq b, x_{1}=0} u\left(\mathrm{~W}+\mathrm{V}-\mathrm{x}_{1}-\mathrm{x}_{2}+\theta\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right)\right) \mathrm{g}\left(\mathrm{x}_{1}, \mathrm{x}_{2}\right)
$$

$$
+\iint_{0<x_{1}, 0<x_{2}} \mathrm{u}\left(\mathrm{~W}+\mathrm{V}-\mathrm{x}_{1}-\mathrm{x}_{2}+\theta\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right)\right) \mathrm{g}\left(\mathrm{x}_{1}, \mathrm{x}_{2}\right)
$$

$$
\mathrm{Eu}(\mathrm{~W})=\int_{0}^{\mathrm{b}} \mathrm{u}\left(\mathrm{~W}_{0}+\mathrm{V}-\mathrm{x}_{1}+\theta\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right)\right) \alpha \cdot \mathrm{f}_{1}\left(\mathrm{x}_{1}\right) \mathrm{d} \mathrm{x}_{1}
$$

$$
+\quad \int_{0}^{\mathrm{b}} \mathrm{u}\left(\mathrm{~W}_{0}+\mathrm{V}-\mathrm{x}_{2}-\theta \cdot \mathrm{P}\right)(1-\alpha) \mathrm{f}_{2}\left(\mathrm{x}_{2}\right) \mathrm{dx}_{2}
$$

$\frac{\mathrm{dEu}\left(\mathrm{W}^{\prime}\right.}{\mathrm{d} \theta}=\int_{0}^{\mathrm{b}} \mathrm{u}^{\prime}\left(\mathrm{W}_{0}+\mathrm{V}-\mathrm{x}_{1}+\theta\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right)\right)\left(\mathrm{I}\left(\mathrm{x}_{1}\right)-\mathrm{P}\right) \alpha \cdot \mathrm{f}_{1}\left(\mathrm{x}_{1}\right) \mathrm{dx}_{1}$

$$
+\int_{0}^{\mathrm{b}} \mathrm{u}^{\prime}\left(\mathrm{W}_{0}+\mathrm{V}-\mathrm{x}_{2}-\theta \cdot \mathrm{P}\right)(-\mathrm{P})(1-\alpha) \mathrm{f}_{2}\left(\mathrm{x}_{2}\right) \mathrm{dx}_{2}=0
$$

Theorem 1: When excluded risks are present and full insurance is offered at an actuarially fair price, all risk averse decision makers choose less than full insurance.

Theorem 2: When excluded risks become larger, that is as $\alpha$ decreases, the decision maker chooses less insurance.

