



Incentives for Ex Ante wildfire risk mitigation in the wildland-urban interface: The relationship between contingent wildfire insurance and fuel management subsidies

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Problem



- ◆ Wildland Urban Interface (WUI): areas where structures (homes & other human developments) are intermingled with forest & other vegetative fuel types. More than 38 million people live in WUI and more are moving in
- ◆ Impact of wildfires in the WUI:
 - Property owners (e.g.: annual average of 900 homes destroyed in fire prone areas)
 - Insurance companies (\$1.7 billion (ISO, 1991), \$3 billion (ISO, 1997))
 - Society (loss of lives, properties, +\$2 billion spent annually toward fire suppression)
 - Environment
- ◆ How to encourage the adoption of loss reduction measures by property owners?



Incentive based approach

- Explore strategies that can influence individuals at the stage of “migration decision making” (moving to urban or wildland-urban):
 - Creating disincentives for moving to WUI
 - Inducing incentives for risk mitigation in WUI (given decision to move to WUI)
- Insurance markets
 - Moving from the standards (pooled) contracts (non contingent on mitigation effort) to insurance **contracts contingent upon mitigation**: pilot program in western states: e.g.: New Mexico, Arizona , Colorado, Utah
- Government
 - **Subsidy** programs for wildfire risk mitigation: some states with costs share programs (New Mexico (75%), Arizona (50%), Colorado (50%))



Objective

- ◆ In a setting where insurance and subsidy programs are combined, our objective is to compare property owners incentives for moving in fire prone zones and investing in fire risk mitigation measures
- ◆ Construct a model in which property owners choose: (1) to move to a given location (U or WUI) and (2) to invest in mitigation based on the following location attributes:
 - Standard insurance contract & No subsidy for mitigation
 - Standard insurance contract & Subsidy for fire risk mitigation
 - Contingent insurance contract & No Subsidy
 - Contingent insurance contract & Subsidy for fire risk mitigation

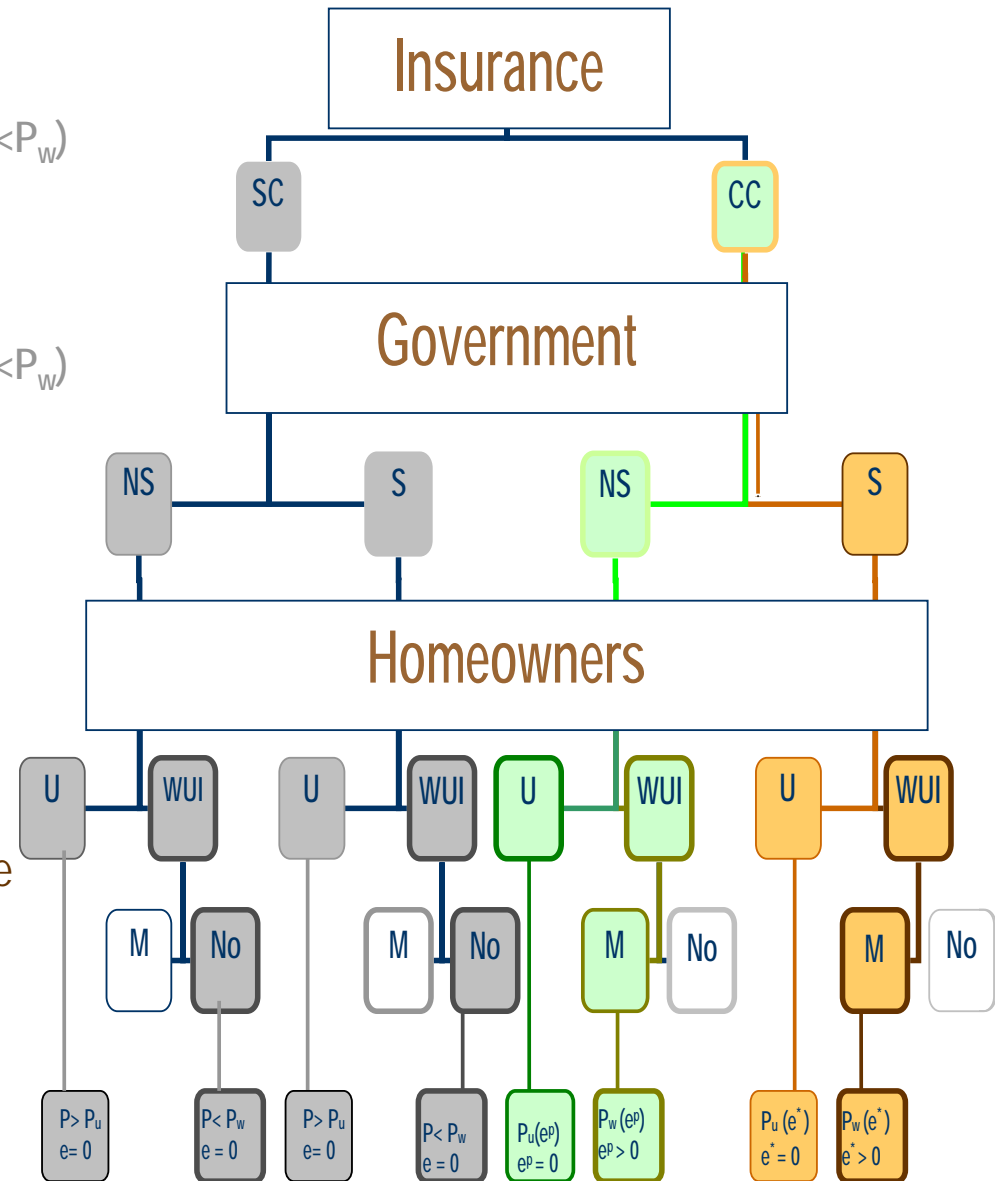
Model

- ◆ **Insurers** offer insurance contract $(P_j(e), Q_j(e))$, contingent or not contingent upon mitigation effort level, e to maximize profit (where $P_j(e)$ is the premium and $Q_j(e)$ is the net compensation)
- ◆ **Government** chooses **subsidy**, for fire risk mitigation to maximize social outcome
- ◆ **Homeowners** choose mitigation level, e , and insurance contract $(P_j(e), Q_j(e))$ to maximize expected utility (EU)

$$\begin{array}{c}
 \text{Expected gains (fire event)} \qquad \qquad \qquad \text{Expected gains (no fire event)} \\
 \boxed{ \text{Max}_{e, Q_j(e), P_j(e)} EU = \pi_j(e)U \left[V_j - \alpha C(e) - \beta_j D + Q_j(e) \right] + (1 - \pi_j(e))U \left[V_j - \alpha C(e) - P_j(e) \right] } \\
 \begin{array}{ccccccc}
 & \nearrow & \nearrow & \nearrow & \nearrow & & \nearrow \\
 \text{Location amenity value} & \text{Risk mitigation costs} & \text{Damage} & \text{Net compensation} & & & \text{Premium}
 \end{array}
 \end{array}$$

Selected Results

- ▶ Standard Contracts (SC) + No subsidy (NS)
 - ◆ Does not discourage settlements in WUI ($P_u < P < P_w$)
 - ◆ No incentive for wildfire risk mitigation (e^0)
- ▶ Standard Contracts (SC) + Subsidy (S)
 - ◆ Does not discourage settlements in WUI ($P_u < P < P_w$)
 - ◆ No incentive for wildfire risk mitigation (e^0)
 - ◆ Subsidy further exacerbates developments in WUI ($EU_{SC-S} > EU_{SC-NS}$)
- ▶ Contingent Contracts (CC) + No subsidy (NS)
 - ◆ Contracts reflect individuals' risk levels P_w, P_u
 - ◆ Incentive for mitigation ($e^P > 0$)
 - ◆ $MSB > MC \Rightarrow$ Second best mitigation incentive
- ▶ Contingent Contracts (CC) + Subsidy (S)
 - ◆ Contracts reflect individuals' risk levels P_w, P_u
 - ◆ Incentive for mitigation ($e^* > e^P > 0$)
 - ◆ $MSB = MPB + MEB = MC \Rightarrow$ First best mitigation incentive





Policy Implications - Directions

- ◆ This paper examine the effectiveness of mitigation based insurance contracts and government subsidy at discouraging migrations to fire prone environments and inducing incentives for mitigation
- ◆ Contingent insurance contracts strengthen incentives for risk mitigation compare to pooled contracts
- ◆ Contingent insurance contracts have the capacity to improve incentives for risk reduction at a private level, and also improve the cost effectiveness of subsidy programs
- ◆ Subsidies for fuel management can improve incentives for risk mitigation, but they also may induce too much development in high-risk areas
- ◆ Looking forward: Relax the “full insurance” assumption



QUESTIONS ?