The Market Structure for Crop Insurance and the Effects on Insurance Contracts

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The Potential for Agent Influence

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Introduction

- The federal crop insurance program is delivered through a public-private partnership between the USDA and the private insurance industry.
- Agent-brokers sell federal policies to producers then re-selling them to insurance companies. Agent commissions are based on the total premium amount and the actuarial performance of their book of business.
- Agents cannot set premium rates, nor are they able to turn away producers that demand a policy. They may attempt to up-sell producers by steering them toward expensive policies.

Research Question

How do insurance agent-brokers leverage market power to influence the crop insurance decisions of producers?

Producer Decision Problem

Producer i can be one of two types with regard to crop insurance knowledge:

1. **Crop insurance experts** choose their level of crop insurance coverage μ_i that maximizes expected indemnity payments less out-of-pocket premiums.

$$\mu_i^* = argmax\ \mathbb{E}\big(I(\mu_i)\big) - \big(1 - s(\mu_i)\big)\rho(\mu_i)$$

- μ_i: Coverage level - percent of historical yield guaranteed by the policy.
- $I(\mu_i)$: Indemnities paid out in the event of loss.
- $\rho(\mu_i)$: Total actuarially fair premium.
- $I(\mu_i)$: Premium subsidy rate paid by government.

2. **Crop insurance non-experts** do not know their optimal μ_i^*. Instead, they approximate it relative to the average coverage level in the county, $\overline{\mu}$.

$$\mathbb{E}(\mu_i^*) = \overline{\mu} + \epsilon_i, \text{ where } \epsilon_i \sim N(0, \sigma_\epsilon^2)$$

Agent-broker Selling Problem

An agent-broker j wishes to sell the coverage level that maximizes his/her sales commission.

$$\mu_j^* = argmax\ \ \mathbb{E}\big(\Pi(\mu_j)\big) = \Big[c\big(\Phi(\mu_j)\big) - z\Big]\rho(\mu_j)$$

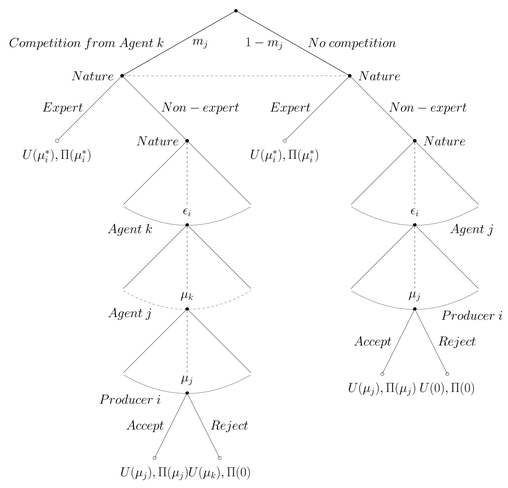
- μ_j: Coverage level agent-broker would like to sell
- $c(\cdot)$: Agent sales commission rate as a percent of total premium collected - function of actuarial performance
- $\Phi(\cdot)$: Actuarial performance of the policy - difference between premiums collected and indemnities paid
- z: Per premium cost of selling and servicing policies

Agent-brokers maximize commissions by balancing marginal profit from increasing premiums with marginal profit from actuarial performance (difference between premiums collected and indemnities paid).

Agent-Producer Interaction Game

An agent-broker j with market share m_j attempts to sell a policy to a representative producer i. The agent competes over producer i's business from an alternative agent k. The interaction proceeds as follows:

1. Agent js market share m_j determines the probability that he faces competition from agent k. Whether agent j has competition is unknown to him.
2. An expert producer immediately demands a policy with their optimal coverage level μ_i^* and enjoys utility $U(\mu_i^*)$. Agent j earns profit $\Pi(\mu_i^*)$.
3. If the producer is a non-expert, agent j observes the his/her ϵ_i and recommends a coverage level μ_j.
4. If agent j faces no competition, he/she wields full influence over the non-expert producer. Producer i accepts the recommendation, gaining utility $U(\mu_j)$ while agent j earns profit $\Pi(\mu_j)$.
5. If producer i receives recommendations from both agent j and agent k, he/she accepts the offer that is closest to his/her approximated optimal coverage $\overline{\mu} + \epsilon_i$. The probability that agent k's competing recommendation is closer to $\overline{\mu} + \epsilon_i$ can be expresses by the CDF $H(\mu_j)$ where $H'(\cdot) = h(\cdot) > 0$.



Without knowing whether he faces competition, agent-broker j must choose a μ_j to recommend to each producer type to maximize expected profit.

- Expert producer:

$$\mu_j^* = \mu_i^*$$

- Non-expert producer:

$$\mu_j^* = argmax\ \Big[m_j + (1 - m_j)\big(1 - H(\mu_j)\big)\Big]\,\mathbb{E}\big(\Pi(\mu_j)\big)$$

Testable Hypotheses

1. Agent-broker market power has no impact on an **expert** producer's level of insurance coverage.

$$\frac{\partial \mu_j}{\partial m_j}\Big|\big(i = Expert\big) = 0$$

2. Agent-broker market power increases the level of insurance coverage recommended to **non-expert** producers if doing so improves actuarial performance.

$$\frac{\partial \mu_j}{\partial m_j}\Big|\big(i = Non - expert\big) > 0\ \ if\ \ \Phi'(\mu_j^*) > 0$$

Data

- To We use a comprehensive, contract-level dataset from two states, Iowa and Oklahoma over multiple years.
- For each policy sold, we observe the level of insurance coverage (total premium collected per acre and total dollar amount insured per acre), characteristics of the policy (crop insured, policy type, acreage insured, etc.), policy performance (indemnity payments made for losses), and the agent that sold the policy.
- We identify *expert* producers as those with high returns from insurance relative to others in their county.

$$R_i = \sum_{t=1}^{T}\big(I_{it} - P_{it}\big)$$

– I_{it}: Total indemnity payments made to producer i in year t
– P_{it}: Total out-of-pocket premiums paid by producer i in year t

$$i = \begin{cases} Expert & \text{if } R_i \text{ is in the 75th percentile for the county} \\ Non - expert & \text{otherwise} \end{cases}$$

Empirical Model

Using an OLS model, we estimate the following two equation:

1.

$$\mu_{ijt} = \alpha_i^1 + \tau_t^1 + \lambda_j^1 + \beta^1 Z_{ijt} + \psi^1 Expert_{ij} + \gamma^1 MarketShare_{ijt} + \phi^1\big(MarketShare_{ijt} \times Expert_{ij}\big) + e_{ijt}^1$$

2.

$$\mu_{ijt} = \alpha_i^2 + \tau_t^2 + \lambda_j^2 + \beta^2 Z_{ijt} + \psi^2 Expert_{ij} + \gamma^2 AgentCompetition_{jt} + \phi^2\big(AgentCompetition_{jt} \times Expert_{ij}\big) + e_{ijt}^2$$

- μ_{ijt}: Measure of insurance coverage chosen by producer i in market j during crop year t (total premium per acre or liability insured per acre).
- α_i, τ_t, λ_j: Producer, crop year, and market fixed effects.
- $Expert_{ij}$: Dummy variable equal to one if producer is deemed a crop insurance expert.
- $MarketShare_{ijt}$: Market share of the agent-broker that sold the policy (% of total policies sold in county j).
- $AgentCompetition_{jt}$: Herfindahl index of agent-broker market concentration in market j (0 = perfect competition, 1 = monopoly).

Results

Iowa Corn & Soybeans Contracts (1995-2002)	Premium Per Acre	Premium Per Acre	Liability Per Acre	Liability Per Acre
$MarketShare$	2.00^{***}		31.18^{***}	
$MarketShare \times Expert$	-1.51		4.66	
$AgentCompetition$		-1.00^{***}		9.49^{***}
$AgentCompetition \times Expert$		-3.78^{***}		2.34
Policy Characteristics	Yes	Yes	Yes	Yes
Producer Fixed Effects	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	$260,824$	$279,039$	$260,824$	$279,039$
Producers	$18,603$	$19,977$	$18,603$	$19,977$
R-squared	0.44	0.43	0.43	0.43

Oklahoma Wheat Contracts (1996-2009)	Premium Per Acre	Premium Per Acre	Liability Per Acre	Liability Per Acre
$MarketShare$	0.04		4.35^{***}	
$MarketShare \times Expert$	-1.39^{***}		-4.39^{**}	
$AgentCompetition$		0.67^{***}		3.29^{***}
$AgentCompetition \times Expert$		-1.80^{***}		-5.87^{***}
Policy Characteristics	Yes	Yes	Yes	Yes
Producer Fixed Effects	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	$143,913$	$168,000$	$143,913$	$168,000$
Producers	$24,816$	$27,173$	$24,816$	$27,173$
R-squared	0.49	0.48	0.57	0.57

Conclusions

- **Agent-broker market power can influence producer insurance decisions**. Tables 1 and 2 show that agent-broker market power has a generally positive impact on total premiums and insured liability for non-expert producers, though effects vary in magnitude. A 10 percent increase in agent market share equals a $0.20 per acre increase in premiums and $3.12 increase in liability insured per acre in Iowa. In Oklahoma, the same increase in market share increases insurance liability by $0.44 per acre. Agent market concentration, as measured by a Herfindahl index, has the predicted positive effect on insurance coverage in three of four specifications. Again, effect sizes vary depending on the state.
- **Expert producers may be less susceptible to agent market power in some cases**. The net effects of agent market share on expert producers is near zero or negative in Oklahoma but not significantly different from non-experts in Iowa. Results suggest that market power may actually reduce coverage taken on by expert producers.
- Support for agent-broker influence in the crop insurance market is demonstrated. Agents with greater market power or those that operate in highly concentrated markets are able to push producers toward more comprehensive, and thereby more expensive, policy types. Producers without expert knowledge of crop insurance may be most susceptible to agent market power.