Fraternities and Labor Market Outcomes

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Fraternities

- Fraternities are more than "club good":
  - too expensive
  - people mention them on resumes
- Fraternity affiliation has positive effect on expected wage.
- Firms and fraternities realize that.
- Fraternities conduct intensive screening of applicants.

Questions

We want to explain

- How people decide whether to pledge.
- How fraternities select students to admit.
- What are the implications of the outcome of the pledge game for the (expected) wages of students of different abilities.

Results Preview

- There is an equilibrium where everybody wants to join.
- There is an equilibrium where some people are accepted but do not apply.
  - It is not the highest types who earn the most from signaling.
  - It is lowest types who are admitted who earn the most.
  - Biggest losers are lowest types who are not admitted.
  - This is the empirical equilibrium, and fraternity membership is economically significant.

The World

- New labor market participants are *students*, mass 1.
- Each student can be represented as a pair $(\theta, \mu) \sim h(\cdot) > 0$.
  - θ is student's potential productivity after employment.
  - μ is student's socializing value.
  - θ and μ are independent.
- Students like money and socializing.
- The representative *fraternity* likes students with high μ and students with high expected wage; has limited capacity.
- *Firms* offer competitive wages:
  - firms observe club membership and a signal about productivity $\widetilde{\theta} \sim f_{\widetilde{\theta}}(\cdot|\theta)$;
  - wage is equal to expected θ conditional on observables.

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Game Timing

1. Students, having beliefs about distribution of other students in a fraternity, decide whether it is profitable to join the fraternity.
2. The fraternity picks an admittance rule.
3. Some students become fraternity members; values of productivity signals are realized.
4. Firms, observing membership of students in fraternity, assign wages to combinations of $\widetilde{\theta}$ and membership status.

In a rational expectations equilibrium, everyone's beliefs are consistent with actions of everyone.

Firm's Problem

Each firm observes a continuum of students with pdf $h(\theta, \mu)$, has a common knowledge of signaling technology $f_{\widetilde{\theta}}(\widetilde{\theta}|\theta)$, and knows the distribution of students in (and out of) the fraternity

$$c(\theta, \mu) = I((\theta, \mu) \text{ is in the club})$$

Then the wage offered to a frat member with signal $\widetilde{\theta}$ is

$$w_C\left(\widetilde{\theta}\right) = \frac{\int \theta h(\theta,\ \mu) c\left(\theta,\ \mu\right) f_{\widetilde{\theta}}\left(\widetilde{\theta}|\theta\right) d\theta d\mu}{\int h\left(\theta,\ \mu\right) c\left(\theta,\ \mu\right) f_{\widetilde{\theta}}\left(\widetilde{\theta}|\theta\right) d\theta d\mu}$$

Student's Problem

Students anticipate wages offered by firms, and possess a common knowledge about signaling technology $f_{\widetilde{\theta}}(\widetilde{\theta}|\theta)$.

Student (θ,μ)'s utility outside the fraternity is

$$U_{\bar{C}} = E_{\widetilde{\theta}}\left[w_{\bar{C}}(\widetilde{\theta})|\theta\right]$$

Student (θ,μ)'s utility inside the fraternity is

$$U_C = E_{\widetilde{\theta}}\left[w_C(\widetilde{\theta})|\theta\right] + n\mu - c$$

Students' solution is:

$$a(\theta,\mu) = I(U_C \geq U_{\bar{C}}|\theta,\mu) \qquad A = ((\theta,\mu)|a(\theta,\mu)=1)$$

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The Fraternity's Problem

The fraternity observes set A and anticipates same wage functions as students do, and picks set B of admitted people. Club's utility function is assumed to be

$$W(B) = W_1 \int_{A \bigcap B} E_{\tilde{\theta}} w_C(\tilde{\theta}|\theta) dH(\theta, \mu) + W_2 \int_{A \bigcap B} \mu dH(\theta, \mu)$$

$$\text{s.t.} \int_{A \bigcap B} h(\theta, \mu) d\mu d\theta \leq \Gamma$$

Here Γ is a fraternity's capacity constraint. Intersection of sets of wishing students A and admitted students B is the set C — fraternity members.

Cutoff Rules

Proposition

There is a cutoff $\mu_A(\theta)$ such that people with μ bigger than that pledge.

Proposition

There is a cutoff $\mu_B(\theta)$ such that people with μ bigger than that are admitted.

Proposition

If signaling technology has a MLRP property, $\mu_B(\theta)$ is decreasing in θ.

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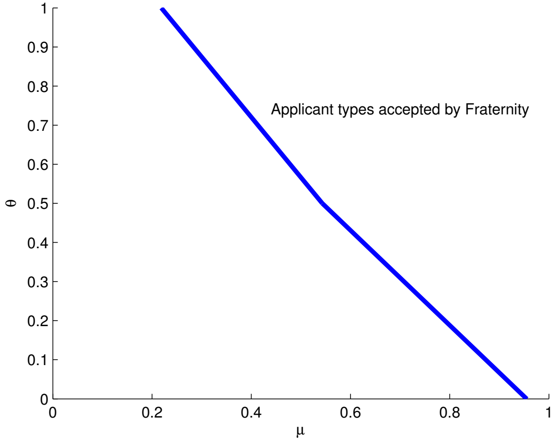
Fraternity's Cutoff Rule



Need Imprefect But Good Signaling

Proposition

If signals $\tilde{\theta}$ are perfectly revealing, fraternity membership in equilibrium does not affect wages.

Proposition

If signals $\tilde{\theta}$ are useless, fraternity membership in equilibrium does not affect wages.

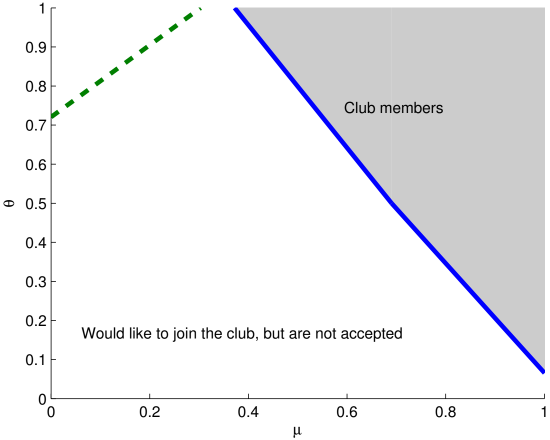
Equilibria Examples

Assume $(\theta, \mu) \in [0, 1]^2$, and (θ, μ) are uniformly distributed. Also assume that three productivity signals are possible: *H*, *M* and *L*.

$$P(\tilde{\theta} = L|\theta) = 1 - 2\theta, \theta \in [0, \frac{1}{2}] \qquad P(\tilde{\theta} = H|\theta) = 2\theta, \theta \in [\frac{1}{2}, 1]$$

Then two classes of nontrivial equilibria can be observed.

Application-Unconstrained Equilibrium



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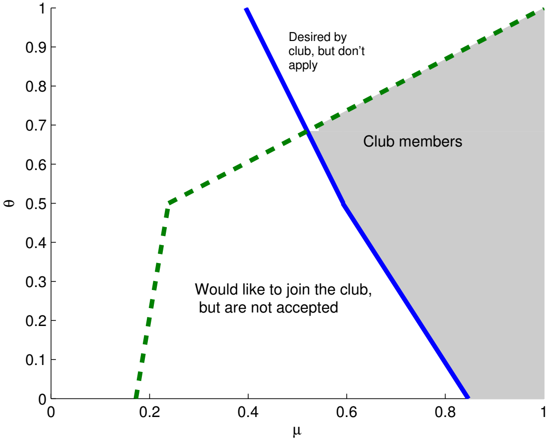

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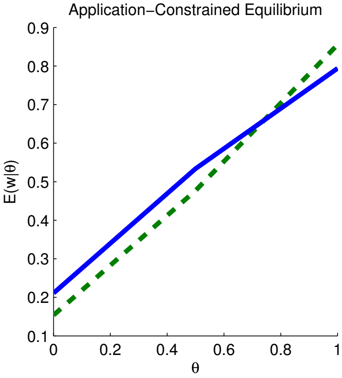
Wages Structure



Single-Peaked Equilibria

Assumption

Either the support for signals $\tilde{\theta}$ is finite, or the support of $f_{\tilde{\theta}}(\tilde{\theta}|\bar{\theta})$ is non-trivial.

Assumption

The cost c of joining the fraternity satisfies $n\underline{\mu} + \bar{\theta} - E[\theta] < c < n\bar{\mu} + \bar{\theta} - E[\theta]$.

Proposition

Suppose that Assumptions 1 and 2 hold, and the fraternity is small enough, the equilibrium is single-peaked.

Data - UIUC Fraternities

- 8634 GPAs of seniors in Fall of 2007.
- 701 GPAs of fraternity/sorority members in Fall of 2007.
- Cannot match — no other info.

$$P(\Phi|\text{GPA}) = P(\Phi)\frac{f_{\text{GPA}}(\text{GPA}|\Phi)}{f_{\text{GPA}}(\text{GPA})}.$$

Consistent estimates of $f(\cdot)$ densities will yield consistent estimate of quantity of members conditional on GPA.

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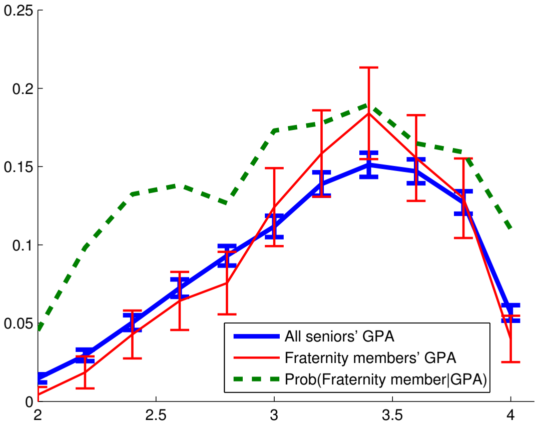
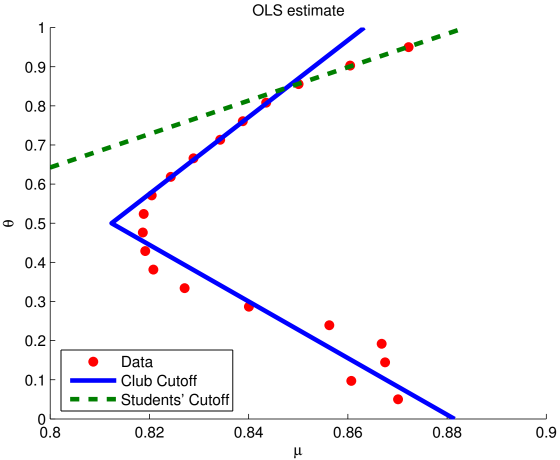
Estimation


0.25
0.2
0.15
0.1
0.05
0
2
2.5
3
3.5
4
All seniors' GPA
Fraternity members' GPA
Prob(Fraternity member|GPA)

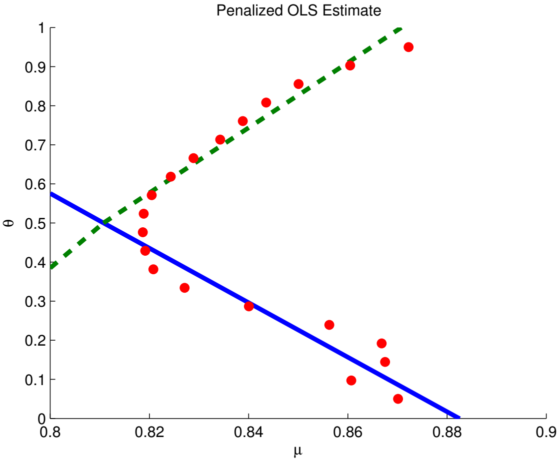
Estimation

- Treat quantiles of GPA as "true" ability.
- Take 20 equispaced points of θ and estimates of $P(\Phi|\theta)$.
- Use the three-signal model, fit pseudopoints into 2-kink cutoff line with OLS.
- Add the condition that the cutoff is consistent with the model.

OLS Estimation



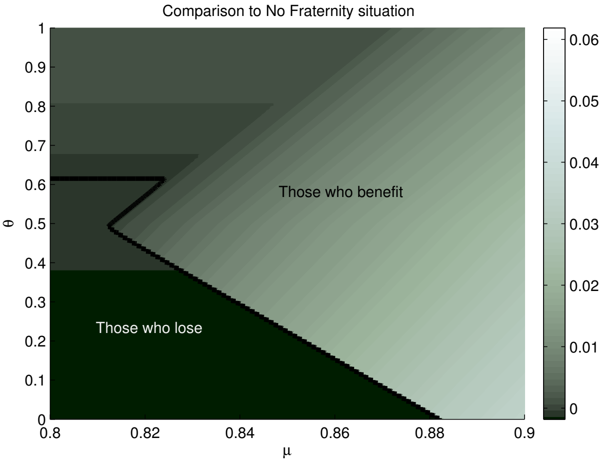
Structural Estimation



Parameters

Parameter	Estimate	95% confidence
n	0.2771	(0.1193, 0.5312)
c	0.2281	(0.0895, 0.4449)
c/n	0.8234	(0.7141, 0.8147)
W_1/W_2	0.2227	(0.0565, 0.3346)
Γ	0.1563	(0.1546, 0.1577)

Welfare Implications



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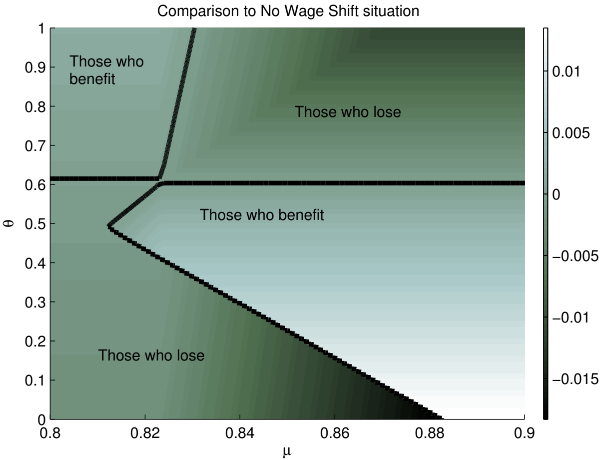

Conclusion

1. Frat members earn higher (on average) wage than non-members.
2. ... not necessarily so when condition on true ability.
3. There are two types of equilibria:
   - application-constrained ("single-peaked");
   - application-unconstrained ("ΦBK").
4. Single-peaked equilibrium exists very generally.
5. We get single-peaked fraternity in estimates.
6. "Single-peaked" effect is damaging for highly-able member students...
7. ... damaging for low-able non-members...
8. ... beneficial for low-type members.