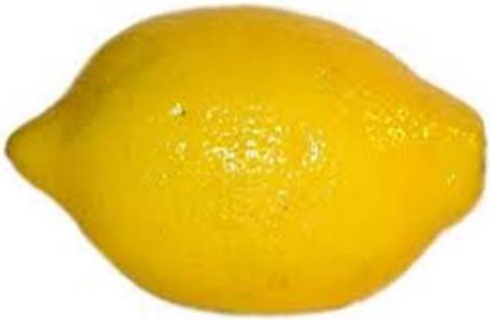
- 3 papers written.

- The 2 I will <u>not</u> present today:

"The More Abstract the Better? Raising Education Cost for the Less Able when Education is a Signal."

"Does Signaling Solve the Lemons Problem?"



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Lemons

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Loons

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Introduction.

- Akerlof (2012, 2013, and with Tong, 2013) has argued individuals often do not behave according to rational expectations (RATEX).

- Akerlof: a *phool* is one who is not stupid, but who makes a mistake.
- *Phishing* occurs as some try to influence others to make mistakes that benefit the phishers.

- Implication: mistakes will always benefit those who phish the phools.
- I call them loons.

- Akerlof uses an example of a complete lemons market (no trade).
- With phools, some trade occurs & buyers lose on average.
- 3 points to consider.

① In Akerlof’s analysis of a lemons market, no phishing is required---buyers make mistakes.

② ∴ Mistakes should go in either direction, either underestimating or overestimating how much trade will occur.

③ Asymmetric information

info. models often assume

$\pi = 0 \Rightarrow$ no gain from phishing.

- QUESTIONS:

1) If loons exist, does their behavior always make them worse off?

2) Can loons increase total welfare?

3) Can the welfare of loons increase when total welfare increases?

- I examine different adverse selection problems when we either have RATEX or loons.

Lemons mkt. set up.

- x = quality.

$x \sim$ U on $[x_{min}, x_{max}]$

- Sellers know what they have

& value a good by x.

- Any buyer who knew x would

pay vx, $v > 1$.

- Perfectly elastic demand.
- Thus, the gain from exchange for a unit of the good = (v -1)x.
- All goods would trade with perfect information.

- Asymmetric information.

RATEX: buyers expect goods with $x \leq x^*$ will trade---the best goods will not trade.

- P = price.

- Buyers will offer:

$v\mathrm{E}(x|x_{min} \leq x \leq x^*) =$

$\frac{v}{2}(x_{min} + x^*)$.

- Sellers with $x \leq x^*$ will trade

if $P = x^*$.

$\therefore$ For goods with $x \leq x^*$ to trade:

$$\frac{v}{2}(x_{min} + x^*) \geq x^*. \qquad (1)$$

- If $v \geq 2$, no lemons problem.

$\therefore$ Focus on the case when $v < 2$

& at least some lemons prob.

occurs:

$vE(x) < x_{max}$,

with $E(x)$ the population mean.

Akerlof's example.

- $x_{min} = 0$, $x_{max} = 2$, & $v = 1.5$.

- *Ineq.*(1) does not hold.

$$\frac{v}{2}(x_{min} + x^*) \geq x^*. \qquad (1)$$

$$.75x^* \geq x^*. \text{ ☹}$$

- No trade would occur with RATEX.
- The gain from trade, G, = 0.
- From now on, normalize total # of goods available to 1.

Loons.

- Akerlof: buyers believe all

goods will trade, offer $P = 1.5$

& will buy any cars at $P \leq 1.5$.

$\therefore P = 1.5$ & $x^* = 1.5$.

Ave. x traded = $\bar{x} = .75$.

traded = .75.

- Consumers value a good with $\bar{x}$ by $v\bar{x}$ = (1.5)(.75) = 1.125.
- On average, consumers lose .375.

$\therefore$ CS = -(.75)(.375) = -.28125.

☹

- PS = (# traded)(P - $\bar{x}$) =

.75(1.5 - .75) = .5625.

☺

- G = CS + PS =

.5625 - .28125 = .28125.

☺

$\therefore$ This fits Akerlof's view phools can be phished.

- If firms are phishers, they gain from phishing.
- What Akerlof did not mention is $\Delta G > 0$.

Less than complete lemons mkt.

- $x_{min} = 1$, $x_{max} = 5$, & $v = 1.5$.

- Now *ineq*.(1) holds.

- Solving *ineq*.(1) for the equality:

$$x^* = \frac{vx_{min}}{2-v}. \qquad (2)$$

$\therefore\ x^* = 3$ (RATEX)

- $P = 3$.
- Goods traded: $x \in [1, 3]$,

so $\bar{x} = 2$.

- .5 goods are traded.

- Buyers value these goods on

average by $1.5(2) = 3 = P$.

$\therefore CS = 0$

Some have $CS > 0$ ($x > 2$),

& some have $CS < 0$ ($x < 2$).

- $PS = .5(P - \bar{x}) = .5(1) = .5$

$\therefore\ G = CS + PS = .5$

Loons1:
Buyers overestimate P

- Suppose buyers offer to buy

any good with $P \leq 4$.

$\therefore P = 4$.

Goods traded: $x \in [1, 4]$,

so $\bar{x} = 2.5$.

- .75 = # traded.

- Buyers on ave. value these goods by 1.5(2.5) = 3.75.

∴ Buyers lose .25 on average.

- CS = -.75(.25) = -.1875

- PS = .75(P - $\bar{x}$)

= .75(1.5) = 1.125.

∴ G = 1.125-.1875 = .9375.

- As in Akerlof's ex., buyers overestimating P

$\Rightarrow CS\downarrow$, $PS\uparrow$, & $G\uparrow$.

- However, mistakes should go in either direction if buyers are phools/loons/irrational.

- In Akerlof's ex., there is no trade with RATEX---can only overestimate P.

Loons2:
Buyers underestimate P

- Suppose consumers offer to buy any good with $P \leq 2$.

$\therefore P = 2$.

Goods traded: $x \in [1, 2]$.

$\bar{x} = 1.5$.

.25 = # traded.

- When buyers *underestimate* *P*, relative to RATEX equilibrium, it is like a binding price ceiling.

- If demand slopes down, with a binding price ceiling, $CS\downarrow$ because $Q\downarrow$, but $CS\uparrow$ because $P\downarrow$.

$\therefore\ \Delta CS$ is ??

- With perfectly elastic demand,

there is no CS to lose as $Q\downarrow$

$\therefore$ $CS\uparrow$ with loons.

☺

- With loons,

CS =(# traded)($v\bar{x} - P$)

= .25[1.5(1.5) – 2] = .0625.

- PS =(# traded)(P - $\bar{x}$)

= .25(2-1.5) = .125.

$\therefore$ G = .1875.

- Relative to RATEX,

CS↑ (from 0 to .0625).

PS↓ (from .5 to .125).

G↓ (from .5 to .1875).

Job market signaling

(welfare cannot be increased)

- The problem as usually modeled is different from the standard lemons model.
- The welfare loss is not due to no trade.

- It is due to expenditure by high quality sellers to differentiate themselves.
- This may simply redistribute wealth.
- Stars productivity = θ_S,

- Lemons productivity = θ_L,

with $\theta_S > \theta_L \geq 0$.

- The fraction of stars in the

population is s.

- The cost of the signal, y is:

$C_{star} = y$ & $C_{lemon} = \beta y$, $\beta > 1$.

- Buyers (firms) compete for workers & break even no matter what: $CS = 0$.
- The lowest level of the signal to induce lemons not to mimic stars is y_{Riley}:

$$y_{Riley} \approx \frac{\theta_S - \theta_L}{\beta}.$$

- Payoff to a star from signaling

is:

$$\theta_S - y_{Riley} = \frac{(\beta - 1)\theta_S + \theta_L}{\beta}.$$

- Total expenditure on the signal (# of individuals = 1) = $s(y_{Riley})$.
- Pooling. If all set $y = 0$, wage = W_{pool}:

$$W_{pool} = s\theta_S + (1-s)\theta_L.$$

$\therefore$ Stars prefer signaling to pooling if:

$$s \leq \frac{\beta - 1}{\beta} \equiv s^*.$$

- Lemons always prefer pooling (they are paid more with pooling).

- If $s < s^*$, signaling occurs & $G\downarrow$ (by $s \times y_{Riley}$) with RATEX.
- If $s > s^*$, pooling occurs & G is as large as possible.

Loons. Lemons are passive---they set $y = 0$ regardless of the equilibrium.

- Stars are the ones who can make mistakes (& affect equilibrium).

- Suppose stars believe their fraction in the population is $\hat{s}$.
- If $s > s^*$ & $\hat{s} < s^*$:

stars would be better off pooling, but they signal; lemons lose (wage↓).

$\therefore$ $G\downarrow$---it must because wasteful expenditure occurs.

- If $s < s^*$ & $\hat{s} > s^*$: stars would be better off signaling, but they pool; lemons gain (wage↑).

$\therefore$ $G\uparrow$---it must because wasteful expenditure is avoided.

- Here behavior by some loony sellers (stars) makes sellers on average better off while $G\uparrow$.

Job market signaling

(welfare can be increased)

- Suppose there is a welfare gain from allocating individuals to different jobs.

One example.

- Social return to screening:

gain when lemons are allocated to where their productivity is highest.

- Absent signaling, all are in the sector where lemons are less valuable.
- Social cost is the expenditure by stars on signaling = $s(y_{Riley})$.

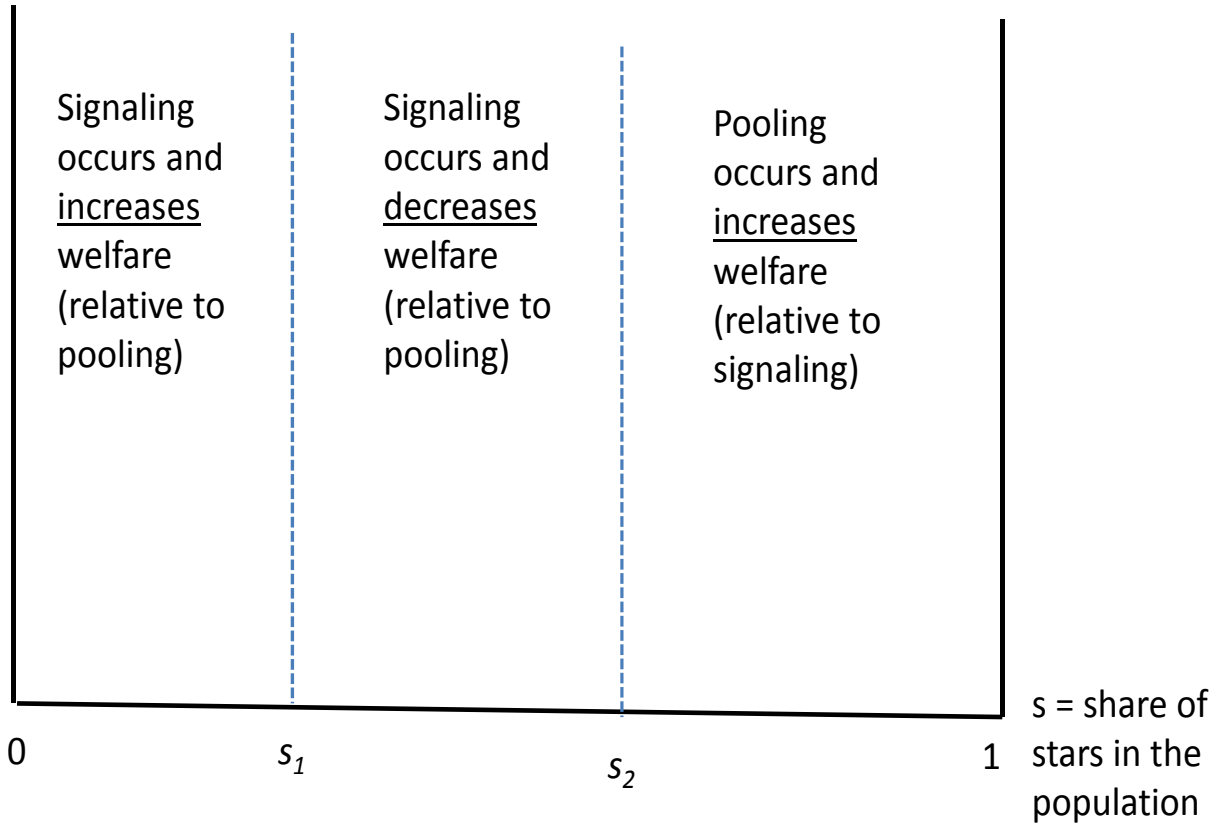
As s↑, social benefit↓ & social cost↑--- fewer lemons to allocate to where they are more productive, & more stars to signal.

$\therefore$ For $s < s_1$, signaling increases G.

For $s > s_1$, signaling decreases G.

- Also, stars will pool if $s > s_2$ (with $s_2 > s_1$).

Figure One. Welfare with signaling and pooling when signaling may increase welfare.



- Let $s = s_2 + \varepsilon$, where ε is a small positive #.
- A slight <u>understatement</u> of s by stars $\Rightarrow \hat{s} < s_2$.
- Stars will signal instead of pooling, & $G\downarrow$.

- Lemons lose because they are paid less with signaling than with pooling.
- Stars lose because they prefer pooling when $s > s_2$.

- Now let $s = s_2 - \varepsilon$, with ε again positive.

- A slight <u>overstatement</u> of s by stars $\Rightarrow \hat{s} > s_2$.

Pooling occurs & $G\uparrow$.

- Lemons gain because they are paid more.
- Stars lose because they prefer signaling when $s < s_2$.

- Here behavior by loony stars that changes the outcome necessarily makes the loons worse off.

- Finally, when $s < s_1$, signaling occurs with RATEX, & yields the highest possible G.
  - In this case, it would take a significant overstatement of s---$\hat{s} > s_2$---to change the outcome.

Simultaneous screening & pooling

- Lazear (1986)

  & Spence (2002).

- Firms screen for

productivity/quality = z.

$z \sim$ U on [0, z_{max}] with one of

each type.

- This differs from signaling (above).

1) A continuum of *z*.

2) Screening is an accurate test (with signaling, quality is revealed implicitly).

3) Simultaneous screening & pooling.

- Let m = screening cost per individual.
- Some jobs do not screen.
- *Salary firms* pay a wage, $w_s = E(z|\text{salary firms})$.

- *Piece rate firms* screen individuals (which reveals z to all firms), & pay $z - m$.
- Screening is a social waste. ☹

- With RATEX, in equilibrium, the marginal individual has $z = z^*$.
- Those with the highest z will be the ones who find it beneficial to screen.

Salary firms pay $z^*/2$.

In equilibrium:

$z^* - m = \frac{z^*}{2}$, so $z^* = 2m$.

- $w_s = E(z|\text{salary firms}) = m$.

- G is reduced by the amount

spent on screening,

$= m(z_{max} - z^*) = m(z_{max} - 2m)$.

Loons

- Assume the mkt. works this way.

  1st, some apply to piece rate firms & screen.

  2nd, others apply to salary firms.

3^{rd}, competition by firms for workers is rational.

$\therefore$ piece rate & salary firms breakeven: $CS = 0$.

- Workers can only be screened initially.
- Otherwise, those who mistakenly go to salary firms only because they overstate w_s would quit & apply to piece rate firms.

The RATEX equilibrium would result.

- Measurement cost is paid by individuals.
- z is revealed to all by measurement.

- Otherwise, salary firms would not know workers did not behave rationally, & would pay *m*.

- The analysis would change only in that some of the gain or loss from loony behavior would be on the part of firms.

Loons1: Individuals underestimate w_s

- η more go to piece rate firms.
- $0 \leq z \leq 2m - \eta$ are in salary firms.

$\therefore \quad w_s = m - \frac{\eta}{2}$.

1) Those who go to piece rate firms with RATEX or with loons are unaffected--- they get $z - m$ in either case.

2) $2m - \eta$ individuals in salary firms lose $\frac{\eta}{2}$ each: their PS falls by $(2m - \eta)\frac{\eta}{2}$.

3) η individuals now in piece rate firms have $E(z) =$

$$\frac{1}{2}(2m - \eta + 2m)$$

$$= 2m - \frac{\eta}{2}.$$

With screening cost of m, their average payoff is $m - \frac{\eta}{2}$.

They would have earned m on average with RATEX at salary firms: their PS falls by $\frac{\eta^2}{2}$.

$\therefore \Delta PS = -(2m - \eta)\frac{\eta}{2} - \frac{\eta^2}{2}$

$= -m\eta$--- due to increased screening cost.

$\therefore$ all in salary firms lose relative to RATEX when individuals understate the wage in salary firms.

Loons 2: Individuals overestimate w

- η more now apply to salary

firms where

$$0 \leq z \leq 2m + \eta.$$

$$\therefore \text{ E}(z|\text{salary firms}) = m + \frac{\eta}{2}.$$

- The $2m$ who are in salary

firms with RATEX

or loons gain $\frac{\eta}{2}$ each for

$\Delta PS = m\eta$.

- Those who would be in piece rate firms with either RATEX or loons still get $z - m$.

$\therefore$ The η who now go to salary firms (& would have gone to piece rate firms with RATEX), must break even on average (proof below).

- Why? Because $\Delta G = m\eta$ ---

reduced screening cost.

- The externality present in

these models benefits the $2m$

individuals.

- When individuals *overstate* w, the η additional individuals who now go to salary firms would have earned $m + \frac{\eta}{2}$ on average (net of screening cost) in piece rate firms.

- However, now $w_s = m + \frac{\eta}{2}$.

These individuals raise w_s enough to offset what they would have netted in piece rate firms.

What is not individually rational for them, does not hurt them on average.

- The externality is they do not take account of the reduction in w_s if they (rationally) go to piece rate firms.

Moral: with asymmetric information, loons may make themselves better off, & may make society better off.

Sometimes loons & society are both better off, but sometimes they are both worse off.

Other times, there are opposite effects on welfare for loons & society. ☹/☺