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Timothy Perri
Appalachian State University

Department of Economics
Appalachian State University
Boone, NC 28608
Phone: (828) 262-2148
Fax: (828) 262-6105
www.business.appstate.edu/economics

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by

Timothy Perri*

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Abstract

Akerlof (2012, 2013) has argued individuals often do not behave according to rational expectations. He shows how buyers in a complete lemon's market are worse off if they behave irrationally---like *loons*. We examine several different lemon's market situations (including when workers may signal or be screened to reveal their quality) to determine the effects on welfare for loons and for society as a whole. Sometimes there are opposite effects for welfare for society and loons. Also, in some cases, both society and loons are better off due to loony behavior.

* Department of Economics, Appalachian State University, Boone, NC, 28608. (perritj@gmail.com)

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1. Introduction

In a series of presentations[1] prior to publication of a book, *Phishing for Phools*, George Akerlof has argued that individuals often do not behave according to rational expectations (RATEX), may ignore the possibility of adverse selection in a lemon's market (Akerlof, 1970), and thus may be worse off because of their naïveté.

According to Akerlof, a *phool* is one who is not stupid, but who makes a mistake. *Phishing* occurs as some try to influence others to do what is not in the best interest of the latter. Akerlof argues "…if people are naïve, markets will take advantage of them" (Yap, 2012). Herein, we say individuals behave as *loons* since one definition of a loon is "a crazy person,"[2] which captures the notion of one being irrational or prone to mistakes.

Akerlof's argument that phools can be manipulated into making mistakes implies the mistakes will always benefit those who phish the phools. Three points are noteworthy regarding the kinds of mistakes phools will make.

First, in Akerlof's analysis of a lemon's market, no phishing is required. All that is necessary is that mistakes are made by buyers. Second, if mistakes do not require phishing, then one would expect mistakes could go in either direction, for example, either underestimating or overestimating how much trade will occur in a lemon's market. Becker (1962) argues we should view an irrational individual as random, and not as one who does the opposite of what would maximize his welfare. Third, there are cases of asymmetric information (labor market signaling and screening for example) where it is usually assumed competition by firms results in zero profit for them. Thus, phishing would not be advantageous for such firms.

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[1] Examples of where Akerlof has presented his work on phishing for phools are Akerlof (2012), a fifty plus minute presentation to the University of Warwick, available as a video, and Akerlof (2013), a PowerPoint presentation at George Washington University. The book *Phishing for Phools* has yet to be published.

[2] Merriam-Webster On Line Dictionary, http://www.merriam-webster.com/dictionary/loon.

For the reasons given in the preceding paragraph, we will consider mistakes that go in either direction. For example, buyers may either understate or overstate what the price would be in a RATEX equilibrium.

Akerlof (2012, 2013) focused on irrational behavior (mistakes) in lemon's markets, that is, with asymmetric information and, possibly, adverse selection. We also analyze problems in such markets. There is no attempt to derive a general explanation for loons. We also do not consider the possibility of learning in markets that can overcome the problem of loons. We simply wish to address the following questions. First, if loons exist, does their behavior always make them worse off? Second, can the behavior of loons actually increase total welfare? Third, can the welfare of loons increase when total welfare increases?

Generally, three things can happen with asymmetric information. First, we can have a lemon's result where goods of relatively high quality are not offered for sale (adverse selection). Second, cost may be incurred to determine quality. In the labor market, this may take the form of signaling by prospective workers or screening by firms. The expenditure on signaling or screening may be a social waste because the revelation of quality may only redistribute wealth from the less able to the more able (Spence, 1974). Third, reputation effects may enable sellers to overcome asymmetric information and induce the sale of high quality goods (Klein and Leffler, 1981, Rasmusen and Perri, 2001).

In order to focus on the possibilities with adverse selection discussed in the previous paragraph, the rest of the paper proceeds as follows. In the second section, we introduce a simple lemon's model. In the third section, we look at Akerlof's (2012, 2103) complete lemon's result. The case with a partial lemon's market is analyzed in the fourth section. In the fifth section, a somewhat different adverse selection problem, job market signaling by prospective workers, is considered. The problem of screening by firms of potential employees differs from that of individual signaling and is considered in the sixth section. Reputation as a solution to adverse selection in the rough diamond market, where DeBeers has been the dominant seller, is discussed in the seventh section. The eighth section summarizes the results herein.

2. Lemon's market setup

Akerlof (2012, 2013) considered a lemon's market problem when there is a uniform distribution of quality, x. Thus we too assume x *is* distributed uniformally on $[x_{min}, x_{max}]$. Each seller of a good with quality x values the good by exactly x. Each buyer would pay vx for a good of known quality, so demand is perfectly elastic. Even with perfect information, a necessary condition to have a market with a gain from trade is for buyers to value cars more than sellers, or $v > 1$.

With asymmetric information and RATEX, buyers infer which goods will be sold. Not knowing x for any particular good, they offer a price equal to the expected value to them. Buyers assume the best goods will not be offered for sale. Only goods below some quality level x^*, will be offered. Thus, buyers offer a price equal to $vE(x|x_{min} \leq x \leq x^*) = \frac{v}{2}(x_{min} + x^*)$, given x is distributed uniformally. Since sellers value their cars by x, the price required by the seller of the highest valued car offered is simply x^*. For cars to be sold with quality $\leq x^*$:

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

A sufficient condition to have no lemon's market is $v \geq 2$. If $v = 1$, both buyers who know x and sellers value a good by the same amount. The average value to a buyer could only equal the maximum value to a seller if $x^* = x_{min}$. If $v \geq 2$, the average value to buyers exceeds the price demanded by the seller of the highest quality good offered $\forall x$. The entire range of goods would be offered for sale: $x^* = x_{max}$.

In general, with $x_{min} > 0$ and $1 < v < 2$, we get $x_{min} < x^* \leq x_{max}$. We have x^* from the equality in *ineq*.(1):

$$x^* = \frac{v x_{min}}{2-v}. \tag{2}$$

For $x^* < x_{max}$, so we have a partial lemon's problem (and not case where all goods trade), with E(x) the population mean of x:[3]

$$v < \frac{2x_{max}}{x_{min} + x_{max}} = \frac{x_{max}}{E(x)}\text{, or} \tag{3}$$

$$vE(x) < x_{max}. \tag{3'}$$

For there to be at least a partial lemon's result with RATEX, the expected value of goods to buyers over the entire range of goods, vE(x), must be less than the maximum value good to a seller, x_{max}. Otherwise, all units will be traded when that would be the case with perfect information.

3. Akerlof's Example of a Complete Lemon's Market

A. Setup and equilibrium with RATEX

[3] Voorneveld and Weibull (2011) allow buyers to receive a noisy signal of quality. The seller does not choose such a signal. They show there is a positive probability high quality goods will trade even with uninformative signals. In order to compare the results herein with those in Akerlof (2012, 2013), we ignore the possibility of an exogenous signal. In Section 5, we consider a signal chosen by sellers.

Akerlof (2012, 2013) considered a problem where (in the notation herein) $x_{min} = 0$, $x_{max} = 2$, and $v = 1.5$. Thus, *ineq*.(1) does not hold, so no trade would occur with RATEX. The gain from trade, G, equals zero.

B. Loons

In the complete lemon's problem, one can only be irrational in one direction since we cannot have a negative amount of trade. Akerlof assumes buyers offer a price, P, equal to 1.5, and will buy any cars at $P \leq 1.5$. In essence these loons naively believe a) the market-clearing P is greater than it would be with RATEX, and b) they will not be losers. Demand is perfectly elastic at $P = 1.5$, so $P = 1.5$**.**

Sellers offer goods with $x \leq 1.5$. The average value of x traded, $\bar{x}$, equals .75. Buyers value for $\bar{x}$ equals 1.5(.75) = 1.125. Thus, buyers on average lose .375. Normalize the total number of goods to one. Then the number of goods traded equals .75. The total loss to buyers is .75(.375) = .28125. Some buyers gain from loony behavior. Anyone who obtains a unit of the good with $x > 1$ is better off since such a good is valued by more than 1.5 and $P = 1.5$.

Sellers gain 1.5 - .75 = .75 on average. The total gain to sellers = .75(.75) = .5625. Thus, G, the sum of consumer surplus (CS) and producer surplus (PS), equals 5625 - .28125 = .28125. Put differently, the gain from exchange, G, of .28125 comes from the fact goods with $\bar{x} = .75$, for which buyers value the goods more than sellers by $.5\bar{x}$ on average, are traded. With .75 the number traded, $G = (.5)(.75)(.75) = .28125$.

In this case, versus RATEX equilibrium, buyers who are loons lose on average, but sellers gain even more. This result fits Akerlof's view that those he calls phools can be phished (exploited) by those who are not phools (loons herein).

4. A Less than Complete Lemon's Market

A. Setup and equilibrium with RATEX

In the previous section, Akerlof's example of irrational behavior (loons) in a world where the RATEX equilibrium is a complete lemon's market---no trade---was considered. As shown in Section 2, there can also be lemon's markets with some trade in RATEX equilibrium. Consider an example similar to that of Akerlof, but with some trade.

Suppose $x_{min} > 0$ and $v = 1.5$. Thus, the equality in *ineq*.(1) can hold. Let $x_{min} = 1$ and $x_{max} = 5$. From *eq*.(2), $x^* = 3$. Also, $\bar{x} = 2$, the average value to buyers is 1.5(2) = 3, and $P = 3$. With perfectly elastic demand and RATEX, the average gain to buyers is zero---there is no *CS*.[4] The average gain to sellers = $P - \bar{x} = 1$, so, with .5 cars sold, the total gain to sellers is .5, and $G = CS + PS = .5$.

G comes from the fact $\bar{x} = 2$, and each unit traded adds $.5\bar{x} = 1$ on average to the gain from exchange, which, with .5 the number sold, yields $G = .5$.

B. Loons 1: buyers overestimate P

Following Akerlof (2012, 2013), suppose buyers *overstate* the equilibrium number of goods that will trade with buyers at least earning zero *CS*. Suppose again we have a perfectly elastic demand for the good, but now this occurs at $P = 4$. Goods with $1 \leq x \leq 4$ are offered, so $\bar{x} = 2.5$. Buyers on average value these goods by $v\bar{x} = 3.75$. Thus, buyers lose .25 on average. With the number sold = .75, $CS = -.75(.25) = -.1875$.

Sellers gain 1.5 on average, so they gain .75(1.5) = 1.125.Thus,

[4] Those who buy goods with $x < 2$ have negative *CS*, and those who buy goods with $x > 2$ have positive *CS*. Total $CS = 0$.

G = 1.125 - .1875 = .9375. *G* comes from the fact .75 of cars are sold, with $\bar{x}$ = 2.5, and a gain of .5$\bar{x}$ on average per car, so *G* = (.5)(2.5)(.75) = .9375. As in Akerlof's complete lemon's market, buyers overestimating *P* means they lose on average (versus RATEX), and sellers gain more than buyers lose, so society gains (d*G* > 0).

C. Loons 2: buyers underestimate P

Unlike the case when no trade would occur with RATEX, a partial lemon's market would have trade. Loons could just as well underestimate the amount of trade that would occur. Now suppose buyers will buy any good if $P \leq 2$. We then have $x \leq 2$ offered for sale and *P* = 2.

What happens when buyers *underestimate* the price relative to what would result in RATEX equilibrium is like a binding price ceiling. In general we would have buyers with different values for *x*, and thus demand would slope down. In that case, with a binding price ceiling,[5] buyers gain from a binding price ceiling because *P* falls, but lose because output, *Q*, falls. Hence, CS could rise or fall.

In the lemon's model of Akerlof, and in the model herein, there is perfectly elastic demand, so *CS* = 0 in RATEX equilibrium. Any *P* below the RATEX equilibrium *P* must result in some positive *CS* as long as *Q* > 0, that is, as long as any trade occurs. There is no *CS* to be lost as *Q* falls since there is no CS in RATEX equilibrium.

With loons, $\bar{x}$ = 1.5, the average car sold is valued by buyers by 1.5(1.5) = 2.25. With *P* = 2, buyers on average *gain* .25. Total *CS* = .25(.25) = .0625 since .25 cars are sold. Sellers gain 2 – 1.5 on average, so *PS* = .5(.25) = .125. Thus *G* = .1875. Put differently, .25 cars with $\bar{x}$ = 1.5 trade, with a gain to society of .5*x* for each car sold, so the average

[5] We ignore implicit price increases by sellers or time costs from queues that would implicitly raise price.

gain = .5(1.5) = .75, and the total gain = .25(.75) = .1875, less than *G* in the RATEX equilibrium. In this case, relative to RATEX equilibrium, *CS* rises (from 0 to .0625), *PS* falls (from .5 to .125), and *G* = *CS* + *PS* falls (from .5 to .1875).

Akerlof concluded that irrational behavior by economic agents (loons) may make them worse off (on average), although, in his example, the gain from exchange actually increased. The example in this sub-section shows how irrationality by economic agents can have opposite effects from those Akerlof found, with loons better off but society as a whole worse off. Still other possibilities may occur with asymmetric information, as we shall see.

5. Job Market Signaling

A. Signaling cannot increase welfare

As in Akerlof's classic lemons model (1970), Spence (1974) analyzed problems of asymmetric information. However, in Spence's model, high quality sellers can, at some cost, signal their quality to prospective buyers. Löfgren *et al*. (2002) suggest Spence showed how informational asymmetries can be eliminated via signaling. However, the problem as usually modeled is different from the standard lemon's model in that the welfare loss is not due to no trade. Rather, it is due to expenditure by high quality sellers to differentiate themselves from low quality sellers, when this may simply redistribute wealth from the former to the latter.

Consider a labor market in which quality implies productivity. Assume two types of individuals, *stars* and *lemons*.[6] Stars have productivity = θ_S, and lemons have productivity = θ_L, with $\theta_S > \theta_L \geq 0$. The fraction of stars in the population is *s*. The usual approach in signaling models is to assume the alternative to signaling is a pooling equilibrium in which the same

[6] Riley (2001) considers signaling with a continuum of quality, and shows how all but the lowest quality individual chooses excessive investment of education in a signaling equilibrium.

individuals are employed in the same jobs with signaling or pooling.[7] This is why the expenditure of stars to signal they are not lemons is a social waste. Relative to pooling, all signaling does is redistribute wealth from lemons to stars, so any expenditure on education lowers the gain from trade. In this sub-section, we consider loons in the basic Spence model when signaling lowers the gain from trade. In the next sub-section, we will analyze the case when signaling could increase the gain from trade.

Consider the standard signaling model where continuous units of some signal, y, may be obtained. As is often argued, suppose y represents units of education which does not affect productivity. All education does is redistribute wealth, so any expenditure on education lowers G. The cost of education is $C_{Star} = y$ for stars and $C_{Lemon} = \beta y$ for lemons, with $\beta > 1$. In a signaling equilibrium, an individual believes, if he obtains a sufficiently large amount of y, employers will believe he is a star, and he will be paid θ_S. Otherwise, he will be viewed as a lemon and paid θ_L. For signaling to occur, a star must want to be correctly identified, and a lemon must not want to mimic a star. Thus, we must have:

$\theta_S - y \geq \theta_L$, or

$$y < \theta_S - \theta_L, \qquad (4)$$

$\theta_S - \beta y < \theta_L$, or

$$y > \frac{\theta_S - \theta_L}{\beta}. \qquad (5)$$

[7] Spence (1974) did consider an extension of his basic model in which there was a social gain from sorting individuals to different jobs. This problem is further considered in Perri (2013a). Hirshleifer and Riley (1992) also consider a case where there is a social gain to signaling from job allocation.

Riley (1979) and Cho and Kreps (1987) demonstrate that the only signaling equilibrium that should survive experimentation by agents is the one with the lowest level of the signal that satisfies *ineqs*.(4) and (5), call it y_{Riley}. Further, Mailath *et al*. (1993) show the more able (stars herein) would not deviate from a pooling equilibrium in which both types set $y = 0$ unless a star is better off signaling, with $y = y_{Riley}$, than pooling. Thus:

$$y_{Riley} \approx \frac{\theta_S - \theta_L}{\beta} \,. \tag{6}$$

The payoff to a star from signaling is:

$$\theta_S - y_{Riley} = \frac{(\beta-1)\theta_S + \theta_L}{\beta}, \tag{7}$$

with this payoff increasing in β because $\frac{\partial y_{Riley}}{\partial \beta} < 0$. Here education does not directly increase productivity (Perri, 2013b), nor does it improve the sorting of individuals to jobs (Spence, 1974, Perri, 2013a). All signaling does is redistribute wealth from lemons to stars (versus pooling; see below), while lowering wealth due to signaling cost. The case when signaling may increase welfare is considered in sub-section B of this section.

If all set $y = 0$, pooling will occur with all receiving a wage and payoff = $s\theta_S + (1\text{-}s)\theta_L$. Using *eq*.(7), a star will prefer signaling to pooling if:

$$s \leq \frac{\beta-1}{\beta} \equiv s^*. \tag{8}$$

Lemons are essentially passive. If stars set $y = y_{Riley}$, lemons are revealed, and they set $y = 0$. If stars set $y = 0$, lemons do the same and pooling occurs. In this problem, and in the screening problem in the next section, sellers are the informed agents, and they are the ones who may act as loons. This is consistent with Akerlof's argument (2012, 2013) that individuals, and not firms, are the ones likely to make mistakes. Also, the obvious way for mistakes to occur in this situation is for stars to misjudge what s is. We have then four possibilities for loony behavior by stars, whose decisions drive the market. Two of these have no impact on the market.

With s = the actual fraction of stars in the population, suppose stars believe their fraction in the population is $\hat{s}$. If $s < s^*$ and $\hat{s} \neq s$, but $\hat{s} < s$, nothing changes: with RATEX or loons, signaling occurs. If $s > s^*$ and $\hat{s} \neq s$, but $\hat{s} > s$, again nothing changes: with RATEX or loons, pooling occurs.

The third possibility is if $s > s^*$ and $\hat{s} < s^*$. Now stars will signal when they should pool. Stars lose and so do lemons who are now paid θ_L versus the amount $s\theta_S + (1\text{-}s)\theta_L$ they would receive with pooling. With signaling or pooling, there is no *CS* (to firms hiring workers) since individuals are paid either their actual or expected productivity. All of *G* goes to individuals as *PS*.[8] *G* is lower than with pooling because of (with the number of individuals normalized to one) the amount $s[y_{Riley}]$ expended on educational signaling.

The fourth possibility is if $s < s^*$ and $\hat{s} > s^*$. Now stars will not signal when they should do so. Stars lose, but lemons gain because they are now paid $s\theta_S + (1\text{-}s)\theta_L$ instead of θ_L---what they would get with signaling. Although stars are worse off because they are loons, *G* rises because *PS* increases by the amount $s[y_{Riley}]$ not expended on signaling. Lemons gain more than stars lose relative to the RATEX equilibrium. Thus, this problem differs from our previous

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[8] Alternative earnings are set equal to zero in this section since they play no role in the analysis unless they are positively related to quality and stars would prefer alternative employment to pooling in this sector. We ignore such a possibility herein.

lemon's market cases because irrationality of some individuals in a group (workers) can make the group better off on average, even though the loons are worse off.

B. Signaling can increase welfare

Perri (2013a) extends the signaling model of Spence (1974) in which welfare---the gain rom exchange, *G*---is greater if individuals are sorted appropriately to different types of jobs. In essence, the results there are the following, given RATEX. If the fraction of stars is low enough, $s < s_1$, stars will signal and the gain to society exceeds the cost of signaling. Thus, signaling is efficient in that welfare increases relative to pooling. If $s_1 < s < s_2$, stars will signal and the gain to society is less than the cost of signaling, so signaling lowers welfare relative to pooling. If $s > s_2$, stars prefer pooling, so the equilibrium involves higher welfare than if signaling occurs.[9] Thus, with RATEX, the outcome (signaling or pooling) with the lowest *G* only occurs if $s_1 < s < s_2$. These results are illustrated in Figure One.

We will only consider loons when the outcome changes. Suppose $s = s_2 + \varepsilon$, where ε is a small positive number. A slight understatement of *s* by stars implies $\hat{s} < s_2$. Now stars will signal instead of pooling, and welfare is reduced. Lemons lose because they are paid less with signaling than with pooling, θ_L versus $s\theta_S + (1-s)\theta_L$. Stars lose because they prefer pooling when $s > s_2$.

Now suppose $s = s_2 - \varepsilon$, with ε again positive. A slight overstatement of *s* by stars yields $\hat{s} > s_2$. Pooling will occur and welfare is increased. Lemons gain because they are paid more, stars lose because they prefer signaling when $s > s_2$, and the gain to lemons exceeds the loss to stars.

[9] The private gain to stars from signaling is the higher wage relative to pooling with lemons. The social gain to signaling is that lemons are sorted to where their productivity is highest, which does not always occur with pooling. As *s* increases, the cost of signaling (social and private; they are the same) increases because there are more stars, and the social benefit falls because there are fewer lemons to reallocate with signaling. Thus, signaling is less likely to increase welfare as *s* increases. At a large enough value of *s*, stars prefer pooling to signaling (as discussed previously). See Perri (2013a) for formal proofs of these arguments.

Finally, when $s < s_1$, signaling occurs with RATEX, and yields the highest possible welfare. In this case, it would take a significant overstatement of s---$\hat{s} > s_2$---to change the outcome. Loony behavior such that $\hat{s} < s_2$ does not affect anyone in this case.

Here behavior by loony stars that changes the outcome necessarily makes the loons worse off. However, if signaling increases welfare, a large overstatement by stars of their fraction in the population is required before there is an effect on the equilibrium.

6. Simultaneous Screening and Pooling

A. Setup and equilibrium with RATEX

Lazear (1986) considers screening by firms of individual quality/productivity. This differs from the signaling model in the previous section in the following ways.

- There is a continuum of individual quality.
- Screening is an accurate test, that is, it direct reveals individual quality. With signaling, quality is revealed implicitly: those who do not obtain as much of the signal as others are viewed as low quality.
- Simultaneous screening and pooling occur (Spence, 2002).

Let m = screening cost per individual. Some jobs do not measure. *Salary firms* pay a wage = expected productivity, E(z|salary firms), z = productivity, with z distributed uniformally with a density of one on [0, z_{max}]. *Piece rate firms* screen individuals, which reveals productivity to all firms, and pay $z - m$.[10]

With RATEX, in equilibrium, the marginal individual, $z = z^*$, is indifferent to being at either type of firm. Since those with the highest productivity will be the ones who find it beneficial to screen, $z^* - m = \frac{z^*}{2}$, so $z^* = 2m$. Thus, the wage, w, at salary firms with RATEX should equal the E(z) at those firms, which equals m. The gain from exchange, G, is reduced by the amount spent on screening, this amount equal to $m(z_{max} - z^*)$.

Assume the market works this way. First, some individuals apply to piece rate firms and screen. Second, all other individuals apply to salary firms. Competition by firms for workers is rational. Thus, both piece rate and salary firms break even, so *CS* is zero. Loony behavior is only on the part of individuals---too many or too few applying to salary firms (versus with RATEX) on their part. Workers can only be screened initially. Otherwise, those who mistakenly go to salary firms only because they overstate the wage there would quit and apply to piece rate firms, and the RATEX equilibrium would result.

B. Individuals understate the wage in salary firms

If individuals *understate* w, more will go to piece rate firms than with RATEX. Suppose the additional number who apply to piece rate firms is η. Those who apply to salary firms have $0 \leq z \leq 2m - \eta$. Thus, E(z|salary firms) = $m - \frac{\eta}{2} = w$.

Now the $2m - \eta$ individuals who go to salary firms, with RATEX or loony behavior, each earn $\frac{\eta}{2}$ less due to loony behavior, for reduced *PS* to them of $(2m - \eta)\frac{\eta}{2}$. The η individuals who

[10] We assume individuals pay for screening up front, so whether they stay at the piece rate firm is immaterial. If worker ability were not publicly known after screening, salary firms would not know workers did not behave rationally, and would pay *m*. The analysis in the text would change only in that some of the gain or loss from loony behavior would be on the part of firms. With firms fully informed and acting rationally, they break even no matter how individuals behave in this model.

go to piece rate firms with loony behavior, who would have gone to salary firms with RATEX, have E(z) = $\frac{1}{2}(2m - \eta + 2m)$ = 2m - $\frac{\eta}{2}$. With screening cost of m, their average payoff is m - $\frac{\eta}{2}$, and they would have earned m with RATEX in salary firms. Thus, their reduction in PS = $\frac{\eta^2}{2}$.

Those who go to piece rate firms with either RATEX or loony behavior are unaffected---they receive z – m in either case. Adding the total losses we have (2m - η)$\frac{\eta}{2}$ + $\frac{\eta^2}{2}$ = $m\eta$---the additional screening cost due to loony behavior.

C. Individuals overstate the wage in salary firms

If individuals *overstate w* in salary firms, fewer will go to piece rate firms than with RATEX. Let η more individuals now apply to salary firms. Now those who apply to salary firms have $0 \leq z \leq 2m + \eta$. Thus E(z|salary firms) = $m + \frac{\eta}{2}$ = w. Those who go to piece rate firms are unaffected.

All those in salary firms earn $\frac{\eta}{2}$ more than with RATEX. Thus, the 2m individuals who would be at salary firms with RATEX or loons all are better off, and gain PS of $m\eta$.

The η individuals who go to salary firms with loons, but not with RATEX, have E(z) = $\frac{1}{2}(2m + 2m + \eta)$ = 2m + $\frac{\eta}{2}$, and, after screening cost, would have an average payoff of $m + \frac{\eta}{2}$ at piece rate firms. They are exactly as well off on average as with RATEX. Thus, the total gain in PS is $m\eta$---the amount by which screening cost has been reduced.

The only individuals who lose are some of the loons who go to salary firms when, with RATEX, they would have gone to piece rate firms. They have above average productivity (for the group), $z > 2m + \frac{\eta}{2}$, and their payoff in piece rate firms would exceed the wage in salary firms. Those from that same group with below average productivity are better off with loony behavior. With a uniform distribution, ½ of those who go salary firms when they would have gone to piece rate firms with RATEX are worse off in salary firms. They number $\frac{\eta}{2}$. Unless η is large, we have an example where loony behavior increases the gain from exchange, and few individuals are worse off (z_{max} -2m - η have the same *PS*).

Note, when individuals *understate* the wage in salary firms, the η individuals who now go to piece rate firms (but would have gone to salary firms with RATEX) are at the lower end of the productivity range in piece rate firms. Thus, their mistake makes them worse off in piece rate firms than they would have been in salary firms. When individuals *overstate* the wage in salary firms, 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 the wage in salary firms equals $m + \frac{\eta}{2}$. The error in assessing w does not hurt (on average) the η who mistakenly go to salary firms. What is not individually rational does not hurt this group (on average) since firms rationally bid up the wage in salary firms, and since screening cost is avoided.

7. DeBeers

The example of DeBeers as a seller of diamonds is considered because it differs in several ways from the cases already considered herein. First, DeBeers is an actual example of a problem of potential adverse selection. Second, DeBeers had, and may still have, monopoly power. Third, DeBeers appears to have been able to use its reputation to overcome adverse selection problems.

DeBeers once controlled 80% of the world supply of rough stones, down to 55% by 2004 (*The Economist*, 2004). DeBeers sells rough stones ten times a year at non-negotiable prices

(Perry, 2006). A client is presented a box of assorted diamonds that vary in type and size, at prices ranging between $1million and $30 million. Buyers take or leave the box, and do not get to remove and measure individual stones (Zoellner, 2006).

Let diamonds of quality x be worth vx to a buyer. Assume DeBeers' reputation ensures it will deliver a box of quality such, with a price equal to P, $[v]E(x) \geq P$. Then avoiding measurement cost implies a gain for buyers and DeBeers. If buyers measure, demand is reduced by the cost per unit of measurement. If sellers measure, their marginal cost (*MC*) increases. In either case, Q is reduced. Although demand decreasing would lower price, and *MC* increasing would raise price, when buyers measure, price plus the cost of measurement would exceed price with no measurement.

Barzel (1977) argues DeBeers reputation is such buyers are willing to buy a pig-in-a-poke. Trust ensures a higher price (or lower *MC*) without measurement (Barzel, 1982). Thus, reputation solves a lemon's problem in this case.

Consider the case when, if anyone measures, it is the monopolist. If buyers are loons and demand measurement when the seller's reputation prevents sellers from offering lemons, marginal cost increases. Let π represent profit. Using Figure Two, with no measurement cost, $P = P_1$, $Q = Q_1$, CS = $A1 + A2 + A3$, and $PS = A4 + A5 + A6 + A7$. With measurement cost, $P = P_2$, $Q = Q_2$, $CS = A1$, and $PS = A2 + A4 + A6$. Thus *CS* falls, and $\Delta PS = A2 - A5 - A7$, so *PS* *could* increase.[11] Considering only irrational behavior by individuals and not by firms, if *PS* would increase due to measurement cost, a profit-maximizing monopolist would measure (since $\Delta\pi = \Delta PS$). Thus, focus on the case when $A2 < A5 + A7$, so a monopolist would not measure.[12] Both buyers and sellers lose if the former are loons and demand measurement.

[11] It does not appear too likely that PS will increase. See the Appendix for when it may.

There are two possible explanations for why measurement does not occur by DeBeers (or by buyers). First, buyers are not loons. Second, buyers are loons but monopoly power by DeBeers prevents buyers from measuring.[13]

There are also two reasons measurement may occur in the future if DeBeers monopoly power continues to erode. First, the reduced bargaining power of the firm may no longer enable them to resist any buyer demands to measure the diamonds sold by DeBeers. Second, reduced future price premiums may no longer be sufficient to induce DeBeers not to shortchange buyers.[14]

Whatever may happen in the future, DeBeers is an example of how reputation costs may prevent either a lemon's result or socially wasteful measurement cost.

8. Summary

Akerlof argues the potential for mistakes by individuals is exploited by others, thus explaining phenomenon such as the recent financial market meltdown in the U.S. Further, he argues firms may use reputation to exploit individuals' naïveté.

The purpose of this paper was not to challenge the idea individuals are not always rational and can sometimes be exploited. Rather, if individuals may make mistakes in markets, it is of interest what the effects of those mistakes would be. Since Akerlof used an example of a lemon's market, the task herein was to consider lemon's markets and other cases of asymmetric information to see the effects when agents are not rational---act as loons.

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[12] If $A2 > A5 + A7$, and measurement occurs by the monopolist, buyers would be quite rational to try to force the monopolist not to measure since CS rises if measurement cost is eliminated, as does $G = CS + PS$.

[13] I know of no evidence that suggests buyers would like measurement to occur. However, if they believe it would be fruitless to request measurement, buyers simply may not bother asking.

[14] See Klein and Leffler (1981) and Rasmusen and Perri (2001) for analysis of price premiums in assuring product quality.

A number of results were obtained. Whereas Akerlof found loons are worse off due to their behavior, although total welfare is higher, the analysis herein suggest a variety of possible results when individuals are loons. Loony behavior may have the opposite effect found by Akerlof, raising welfare for loons, but not total welfare. Additionally, loons may make society better by reducing signaling or screening costs when signaling or screening lower total welfare. In some cases, both society and loons (on average) are better off due to loony behavior.

We have considered only markets in which asymmetric information exists, and thus welfare may be reduced below the level attainable if information were less costly. We have done so for two reasons. First, such a market is used by Akerlof (2012, 2103) to demonstrate that mistakes may make individuals worse off. Second, one would expect such mistakes to be more likely in situations in which information is costly (at least for some agents). In these cases, there is the possibility irrational behavior may actually improve welfare.

In sum, irrational behavior can be bad for those who behave irrationally, but that is only one of many possibilities. As a general principle, irrational behavior is not an explanation for markets performing worse than one would expect with rational agents.

Appendix

Can PS increase when MC increases?

In all cases, we assume total cost = $TC = cQ$, so c = marginal and average cost, independent of Q. Also both a and b are demand parameters that are positive constants. Thus $PS = \pi$ in this case, but, even with fixed cost, $\Delta PS = \Delta\pi$.

With a linear demand, suppose $P = a – bQ$. Profit is then $\pi = (a - bQ -c)Q$. The profit-maximizing Q and P are $Q = \frac{a-c}{2b}$ and $P = \frac{a+c}{2}$, with $a > c$ for $Q > 0$. Maximum profit is then $\pi = \frac{(a-c)^2}{4b}$, so $\frac{\partial\pi}{\partial c} < 0$. The monopolist loses profit if MC increases.

Now let demand equal $P = aQ^{-b}$. Then $TR = aQ^{1-b}$, and $MR = a(1-b)Q^{-b}$. Thus $b < 1$ for $MR > 0$. Setting $MR = MC$, the profit-maximizing Q and P are $Q = \left[\frac{a(1-b)}{c}\right]^{1/b}$ and $P = \frac{c}{1-b}$. Maximum profit is then $\pi = \frac{b}{1-b}[a(1-b)]^{1/b}c^{\frac{b-1}{b}}$, so, with $b < 1$, again $\frac{\partial\pi}{\partial c} < 0$.

Finally, let demand equal $P = ae^{-bQ}$, with e the natural exponent. Then $TR = aQe^{-bQ}$ and $MR = a(1-b)e^{-bQ}$, so again $b < 1$ for $MR > 0$. Setting $MR = MC$, the profit-maximizing Q and P are $Q = \frac{1}{b}ln\left[\frac{a(1-b)}{c}\right]$ and $P = \frac{c}{1-b}$. Note, $a(1-b) > c$ for $Q > 0$. Simplifying terms, maximum profit is then $\pi = \frac{c}{1-b}ln\left[\frac{a(1-b)}{c}\right]$, and $\frac{\partial\pi}{\partial c} = \left\{\frac{1}{1-b}\right\}\left\{ln\left[\frac{a(1-b)}{c}\right] - 1\right\}$. Thus, π increase as MC increases only if $\frac{a(1-b)}{c} > e \approx 2.718$. A larger a implies a greater intercept for demand, and a smaller b implies a smaller elasticity of demand. Profit will decrease as MC (c) increases if MC is too large.

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

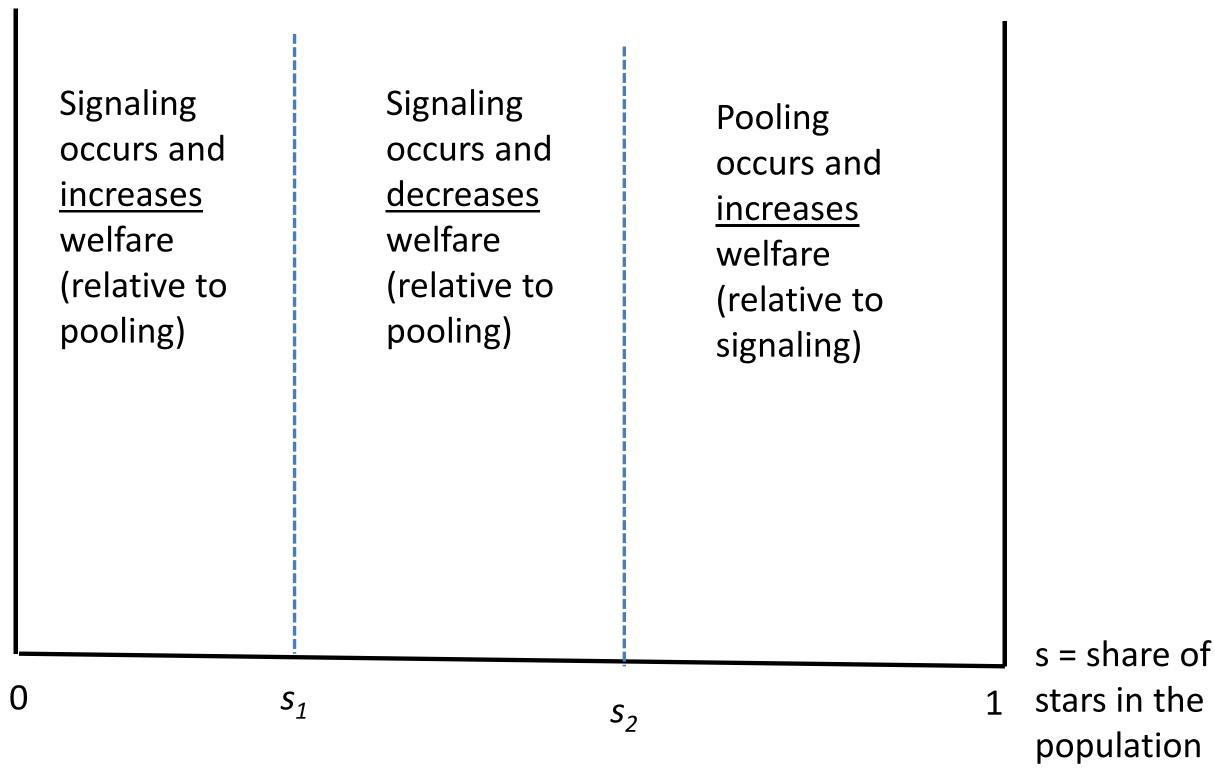
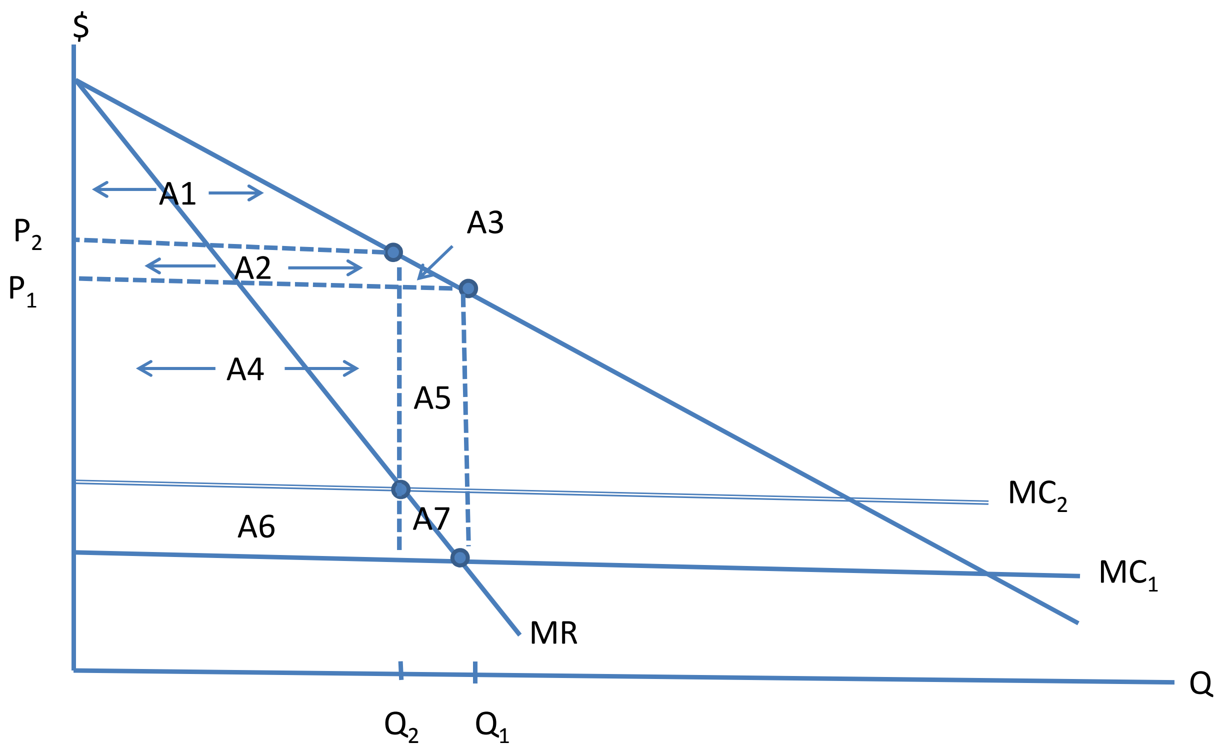


Figure Two. A monopolist that can choose to measure quality, thus raising MC.



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