# Pricing on the Market with Imperfect Information:

# the Lemon market example reconsidered

**By**

**Katarina BUJDAKOVA**

**THESIS**

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
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Supervisor ***Sang-moon HAHM*** ________________

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**To my parents Alicia & Milan**

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# Pricing on the Market with Asymmetric Information: the Lemon market example reconsidered.

By Katarina Bujdakova

Abstract

Akerlof (1970) describes the consequences the information asymmetry has on the quality and quantity traded using a used car market example. He finds that price and quality of the cars traded is on average lower than in the case of perfect information and that in extreme case only bad cars are traded and market eventually collapses. This paper reconsiders Akerlof's lemon market example in slightly different context, and it attempts to answer questions: "Why buyers prefer to buy used cars from large scale sellers? How does company size relate to the sellers' cheating under imperfect information?" This paper investigates the impact of the scale of trade and the cost structure on seller's honesty. It is found that with decreasing unit costs of fixing a car, large-scale sellers tend to behave honestly at lower price levels than small-scale ones do. This finding is compatible with usual explanations offered by CEOs that large companies sell at lower prices due

to their scale-related cost savings. This paper also finds that even if the sellers have constant unit costs, so that there are no economies of scale, the larger-scale sellers would behave honestly at lower price levels. In the case of the sellers with increasing unit costs, the scale of trade is found to have ambiguous effect on price necessary to prevent cheating.

## 1. Introduction

This paper shows how information, or more likely its absence, can distort pricing mechanism and how is the extent of this distortion influenced by the scale of trade and the cost structure. A simple model of the pricing on the lemon market is used, similar to the one described in the automobile market example by Akerlof (1970). This model considers only used cars and the seller can improve a car's quality by fixing it at some cost before sale.[1] All the cars are assumed to have same (low) quality initially and the fixing decision by seller determines whether a car becomes a peach or a lemon. The buyer cannot tell the difference in a car's quality at the time of purchase. Thus peaches and lemons sell at the same price. With time the buyer improves his knowledge about the car's quality as the lemons can break down more often than peaches. This relatively high break down frequency can be looked at as the alternative to the imperfect screening technique.

Previous research on pricing on the lemon market focuses mostly on welfare effects. Heinkel (1981) examines the policy implications of administering an ex post imperfect quality test with potential seller liability. He finds that the effec-

[1] The idea of fixing a car was also used by Heinkel (1981), however in his paper average car quality among sellers differ, so that they incur different fixing cost.

tiveness of this test is contingent on three basic variables: the size of the liability, the confidence level of the test and the degree of test imperfection (noise) and that an imperfect test technology can improve total surplus.

Levin (2001) focuses on gains from trade on lemon market and finds that greater information asymmetry does not necessarily reduce gains from trade. The measure of trade used in his paper is not a price at which the cars are traded but rather the maximum probability with which they are traded. Buyers observe signalling and then adjust their beliefs about the quality distribution of cars traded. Levin (2001) finds that an increase in information can increase or decrease trade, depending on the initial trade levels. Other authors observe that in models with signalling (Crocker and Snow, 1992) or screening (Kessler, 1998), private information can have ambiguous impact on welfare.

Some authors tested the Lemon market pricing directly using empirical data. Bond (1982) uses data from TIU Survey on pickup trucks to compare maintenance cost of trucks acquired new and trucks acquired used (potential lemon market). He finds no significant difference in maintenance of new and used trucks. However, as pointed out by Pratt and Hoffer (1984), this finding might be caused by problems in measurement technique. Reexamining same data they find a significant difference in maintenance. Chezum and Wimmer (1997) examine thoroughbred yearlings auction market data to compare prices at which breeders and racers sell horses. They find that breeders receive on average higher prices for similar yearlings since breeders sell all their horses and racers tend to keep potentially successful horses out of auction (adverse selection).

The current paper does not implement any active monitoring technique administered neither by buyer nor by an authority. Buyers only passively observe the quality of a car they bought and adjust their behavior in the future. This paper focuses on the price level rather than welfare surplus. This paper aims to contribute to the discussion of the lemon market problem by reconsidering it in slightly different context, and to answer questions: "Why used car buyers prefer to buy from large scale sellers? How does company size relate to the sellers' cheating under imperfect information?" This paper investigates the impact of the scale of trade and the cost structure on seller's honesty. It is found that with decreasing unit costs of fixing a car, large-scale sellers tend to behave honestly even at relatively low used car prices. This paper also finds that even if the sellers do not experience cost savings, and have constant unit costs, and thus there are no economies of scale, the larger-scale sellers would be honest at lower price levels.

In the case of the sellers with increasing unit costs, the scale of trade is found to have ambiguous effect on price necessary to prevent cheating.

The paper is organized as follows: Section 2: Simple model is introduced, Section 3: The incentive compatibility condition is derived and its implications in the market equilibrium are considered. Section 4: concludes.

## 2. The Model

The economy consists of a large number of buyers and a large number of sellers. Sellers maximize present value of current and future profits and buyers maximize utility. Both behave competitively and discount future at rate $r$. Model is set in discrete time.

### 2.1 Seller

There are $n$ identical sellers on the market. Each seller sells $m$ cars per period. Thus total supply of cars per period in the economy is $N = mn$. Each seller fixes used cars and sells them to buyers. Any car eventually breaks down. If a seller sells a car after fixing it, the car breaks down with probability $q_1$. If he sells car without fixing it, the car breaks down with probability $q_2$ (where $q_1 < q_2$). If cars he is selling break down, a buyer is reluctant to buy cars from him and the seller is forced to leave the market. The buyer cannot distinguish whether his car broke down because it was not fixed by the seller or because of some other reason. A seller previously out of business comes back to business at some rate $a$, and sells cars again, regardless of his past performance.

Total cost of fixing cars per seller in business is $c(m_f) = \delta_1 m_f + \frac{1}{2}\delta_2 m_f^2$, where $m_f$ is the number of fixed used cars and $\delta_1 > 0$, $c'(m_f) = \delta_1 + \frac{1}{2}\delta_2 m_f \geq 0$ and $c''(m_f) = \delta_2$. Since the sign of $c''(m_f)$ depends on the sign of $\delta_2$, we will consider three possible cases: first, when $\delta_2 = 0$, and total cost increases at constant rate with $m_f$, second when $\delta_2 > 0$, and total cost increases at increasing rate, and finally when $\delta_2 < 0$, and total cost increases at decreasing rate.

Each seller decides how many cars to fix before selling them. His profit is as follows

$$\Pi = pm - c(m_f) = pm - \left(\delta_1 m_f + \frac{1}{2}\delta_2 m_f^2\right) \tag{2.1}$$

where $m = m_f + m_d$

$p$: price of a used car,

$m$: number of used cars sold per seller,

$m_f$: number of used cars sold after being fixed,

$m_d$: number of used cars sold without being fixed,

$c(m_f) = \delta_1 m_f + \frac{1}{2}\delta_2 m_f^2$: fixing costs incurred by seller (per period)

The payoff of the honest seller in business can be obtained as follows. ($G_{BH}$ stands for "gain of honest seller in business")

$$G_{BH} = pm - c(m) + \frac{1}{1+r}\left[(1-q_1)G_{BH} + q_1 G_{OB}\right] \tag{2.2}$$

The payoff in the first period is $pm - c(m)$. Since an honest seller fixes all his cars, $m = m_f$ in (eq. 2.1). In the following period the seller continues to fix used cars and sell them with probability $(1 - q_1)$, i.e., the probability that a car does not break down for reasons others than the seller's dishonesty. If not, with probability $q_1$ the seller goes out of business because the car he sold broke down for natural reasons. $G_{OB}$ stands for "gain of seller out of business." Equation (2.1) may be rewritten as follows:

$$G_{BH} = \frac{1+r}{r}\left[pm - c(m)\right] - \frac{q_1}{r}(G_{BH} - G_{OB}) \tag{2.3}$$

Note that we need a feasibility condition that the price of a used car must be greater than the unit cost of fixing the used car. Later we will show that the feasibility condition is satisfied in equilibrium.

The payoff of the dishonest seller in business is ($G_{BD}$ stands for "gain of dishonest seller in business")

$$G_{BD} = pm + \frac{1}{1+r}\left[(1-q_2)\,G_{BD} + q_2 G_{OB}\right] \tag{2.4}$$

Thus the seller gains $pm$ in the first period. Since the dishonest seller does not fix any of his cars before selling them, $m = m_d$ in (eq. 2.4). In the following period with probability $(1 - q_2)$, the cars he sold do not break down, and he continues to sell cars without fixing them in the following period. With probability $q_2$ the previously sold cars that were not fixed break down. In this case, the seller goes out of business. Equation (2.4) can be rewritten as follows:

$$G_{BD} = \frac{1+r}{r}pm - \frac{q_2}{r}(G_{BD} - G_{OB}) \tag{2.5}$$

If the seller is out of business his payoff is as follows ($G_{OB}$ stands for "gain of seller who is out of business")

$$G_{OB} = \frac{1}{1+r}\left[aG_{BH} + (1-a)\,G_{OB}\right] \tag{2.6}$$

The seller who is out of business gets zero payoff in the present period, but in the following period he may return to business and sell cars again with probability $a$ or with probability $(1-a)$ he remains out of business. Equation (2.6) can be rewritten as follows:

$$G_{OB} = \frac{a}{r}\left(G_{BH} - G_{OB}\right) \tag{2.7}$$

### 2.2 Incentive Compatibility Condition (ICC)

In order to prevent cheating among sellers the price must be high enough to assure that $G_{BH} \geq G_{BD}$. Thus, we are interested in finding the lowest possible price that satisfies the inequality above, the price $p$ at which payoff of the honest seller is equal to the payoff of a dishonest seller.

$$G_{BH} = G_{BD}$$

Thus setting (eq. 2.3) and (eq. 2.5) equal we get

$$(G_{BH} - G_{OB}) = \frac{1+r}{q_2 - q_1} c(m) \tag{2.8}$$

Substracting (eq. 2.7) from (eq. 2.3) we get

$$(G_{BH} - G_{OB}) = \frac{1+r}{r+a+q_1} [pm - c(m)] \tag{2.9}$$

Substituting for $(G_{BH} - G_{OB})$ back to the original equations we get

$$p = \frac{r + q_2 + a}{q_2 - q_1} \frac{c(m)}{m} \tag{2.10}$$

Note that the price of a used car is greater than the unit cost of fixing used cars if $r + q_2 + a > q_2 - q_1$. The feasibility condition holds since $r$, $a$, and $q_1$ are all positive.

According to (eq. 2.10), the minimum price of a used car needed to induce each seller to fix cars ($p$) is increasing in the unit cost of fixing used cars ($c(m)/m$), the rate of returning to business ($a$), the probability of breakdown for fixed cars ($q_1$), and decreasing in the probability of breakdown of unfixed cars ($q_2$).

Note also that if price of a used car is less than the minimum price $p$ in (eq. 2.10), each seller does not have an incentive to fix cars before selling them. Then, each buyer knows that all the cars offered for sale are lemons and the economy will converge to the equilibrium with no trade.

### 2.3 Buyer

In each period, buyers buy $m$ used cars per seller and face a downward sloping demand schedule for good cars $D(p)$. Buyers do not value lemons. Total number of cars purchased by buyers in each period is $N$. Aggregate demand for used cars $N = D(p)$ or $p = D^{-1}(N)$.

## 3. Market Equilibrium

Now let us consider the model from the point of view of the economy. As indicated, there are $n$ sellers on the market and every seller sells $m$ cars each period, there are $N = nm$ cars for sale each period in the whole economy. Let $T$ be the number of potential sellers available in the economy (in or out of business). In equilibrium, the number of sellers leaving business must equal the number of sellers returning to business.

$$a(T - n) = q_1 n \tag{3.1}$$

Since $\frac{N}{m} = n$, the rate at which sellers who are out of business return back to business can be rewritten as follows

$$a = \frac{q_1 N}{(mT - N)} \tag{3.2}$$

Substituting (eq. 3.2) into (eq. 2.10), the minimum price required to prevent cheating among sellers becomes

$$p = \frac{r + q_2 + \frac{q_1 N}{(mT-N)}}{q_2 - q_1} \left( \frac{c(m)}{m} \right) \tag{3.3}$$

which is

$$p = \frac{r + q_2 + \frac{q_1 N}{(mT - N)}}{q_2 - q_1} \left( \delta_1 + \frac{1}{2} \delta_2 m \right) \tag{3.4}$$

As can be seen from (eq. 3.4), the minimum price needed to induce each seller to fix used cars depends on $m$, the number of cars each seller sells, even though $\delta_2 = 0$, i.e., the unit cost of fixing cars is constant. More specifically, suppose $\delta_2 = 0$. Then, the total cost is increasing at a constant rate as $m$ increases. In this case the minimum price required to prevent cheating among sellers is

$$p = \frac{1}{q_2 - q_1} \left[ (r + q_2)\, \delta_1 + \delta_1 \frac{q_1 N}{(mT - N)} \right] \tag{3.5}$$

We differentiate $p$ with respect to $m$ to get

$$\frac{\partial p}{\partial m} = -\frac{1}{q_2 - q_1} \delta_1 \frac{q_1 N}{(mT - N)^2} T < 0$$

Since $\frac{\partial p}{\partial m} < 0$, it is clear that for given $N$, with increasing $m$, the price $p$ necessary to prevent cheating among sellers decreases, since as $m$ increases, the probability of returning to business decreases and each seller will be reluctant not to fix cars. Thus with $m$ large, the minimum price of used cars doesn't have to be high to induce sellers' honesty.

In general, to study the effect of increase in $m$ on the minimum price required to prevent cheating among sellers for given $N$, we differentiate price $p$ in (eq. 3.4) with respect to $m$

$$\frac{\partial p}{\partial m} = \frac{1}{q_2 - q_1}\left[-\delta_1 \frac{q_1 N}{(mT-N)^2} T + \frac{1}{2}\delta_2(r+q_2) + \frac{1}{2}\delta_2 \frac{q_1 N}{(mT-N)} - \frac{1}{2} m\delta_2 \frac{q_1 N}{(mT-N)} T\right]$$

From here we can see that if $\delta_2 < 0$, and the total cost of fixing car is positive, $\frac{\partial p}{\partial m} < 0$. That is, if the fixing cost is increasing at decreasing rate (maybe due to the economy of scale), then as the number of cars the sellers sell per period increases, the minimum price necessary to prevent cheating decreases as long as the total cost of fixing a car is positive.

From equation above we get:

$$\frac{\partial p}{\partial m} \gtreqless 0 \text{ as long as } (r + q_2 + a)\frac{\frac{1}{2}\delta_2 m}{\delta_1 + \frac{1}{2}\delta_2 m} \gtreqless \frac{a}{\left(1 - \frac{n}{T}\right)}$$

Then, as $m$ increases, the price $p$ necessary to prevent cheating increases, if the sum of discount rate, the probability of breakdown for unfixed cars and the probability of returning to business $(r + q_2 + a)$, times the share of variable cost in unit cost of fixing car $\left(\frac{\frac{1}{2}\delta_2 m}{\delta_1 + \frac{1}{2}\delta_2 m}\right)$ is greater than the probability of returning to business $a$ divided by the ratio of sellers out of business $\left(1 - \frac{n}{T}\right)$.

Thus we can conclude that the size of the seller's business definitely matters. The impact is influenced by the cost structure too. If the unit cost constant as $m$ increases (case when $\delta_2 = 0$), increase in $m$ (keeping other things equal) will unambiguously decrease the price $p$ necessary to prevent cheating. The same is true if $\delta_2 < 0$, and the unit cost is decreasing as $m$ increases. This implies that as the seller becomes relatively larger, he matters more in the economy and therefore has more to lose if he's discovered cheating. Thus he will be honest at lower price than when he was relatively small. However, if $\delta_2 > 0$, and the unit cost is increasing as $m$ increases, the effect of increase in $m$ on price is ambiguous, and both an increase and a decrease in price $p$ are possible.

Perhaps it may not be surprising that there is a size effect, that is, an increase in $m$ decreases the minimum price needed to induce each seller to fix used cars if the unit cost of fixing used cars decreases with $m$. Yet we find it interesting to learn that an increase in $m$ reduces the minimum price even when the unit cost of fixing used cars does not vary with $m$, that is there are no economies from scale effects. This results from the fact that given the probability that he may not make any profit, an honest seller would like to sell as many cars as possible while in business.

### 3.1 Comparative Statics

In equilibrium, demand for used cars must equal supply for used cars, thus we get

$$D^{-1}(N) = \frac{r + q_2 + \frac{q_1 N}{(mT-N)}}{q_2 - q_1} \left( \delta_1 + \frac{1}{2}\delta_2 m \right) \tag{3.6}$$

The RHS of (eq. 3.6) is the ICC condition. ICC curve shifts down as

(a) discount rate $r$ decreases

(b) breakdown probability $q_2$ increases

(c) breakdown probability $q_1$ decreases

(d) fixed unit cost $\delta_1$decreases

(e) the effect of number of used cars offered for sale (by a seller, per period) $m$ depends on variable unit cost $\delta_2$ (as shown above if $\delta_2 \leq 0$, increase in $m$ will cause a decrease in price $p$, if however $\delta_2 > 0$, the effect of increase in $m$ is ambiguous)

As can be seen from the figure 1, when aggregate ICC shifts down to ICC', price decreases from $p^*$ to $p^{**}$, and quantity demanded increases from $N^*$ to $N^{**}$.

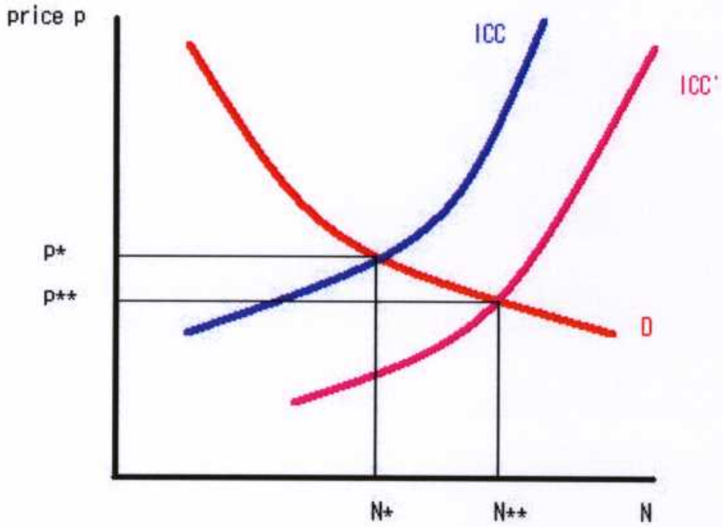


Figure 3.1: Simple comparative statics

## 4. Concluding remarks

This paper develops a simple pricing model of lemon market, similar to the one used by Akerlof (1970), in order to investigate the incentives behind the seller's honesty. Two mechanisms are used to motivate the seller not to cheat, resembling those widely known as "carrots and sticks." First, the seller is building his reputation by selling fixed cars (high quality) or unfixed cars (low quality). The buyer buys a car, which quality he cannot judge about at the moment of trade, but later improves his information about the car's quality and adjusts his behavior toward the seller in the next period. If the seller was cheating and didn't fix the car before selling it, the buyer will find out with probability $q_2$ as the car breaks down. If the seller was honest and fixed the car before selling it, the car can break down with probability $q_1$. If the car broke down for whatever reason the buyer will not come to the seller again. Thus the seller who is identified as a cheater or an unlucky seller is forced to leave the business.

The seller can return to business with probability $a$. Since a car can break down for two reasons: seller's dishonesty (break down probability $q_2$) and natural reasons (break down probability $q_1$). The seller will be honest if the price he can sell for is sufficiently high. The price level depends on break down rate $q_1$, break down rate $q_2$ , discount rate $r$, fixing cost $c(m)$ also on the scale of trade $m$.

Depending on the cost structure, $m$ can increase or decrease price required to prevent seller's cheating. In the case when $\delta_2 \leq 0$ and the unit cost is constant or decreasing in $m$, this effect is unambiguous and larger sellers will behave honestly even at lower price levels. However, if the unit cost is increasing as $m$ increases, the increase in $m$ will have ambiguous effect, and can increase or decrease the minimum price $p^*$ necessary to prevent sellers' cheating. This paper is one attempt to investigate the impact of the scale of trade on the minimum price necessary to prevent cheating under the typical setup of a representative agent model. Further research might clarify how does the scale of trade influence the minimum price if other factors behind agent's honesty are taken into account.

**APPENDIX**

According to (eq. 2.3) and (eq. 2.4), the payoff of an honest seller becomes

$$G_{BH} = \frac{1+r}{r}\left[pm - c(m)\right] - \frac{q_1}{r}\frac{1+r}{r+a+q_1}\left[pm - c(m)\right]$$

$$= \frac{1+r}{r}\frac{r+a}{r+a+q_1}\left[pm - c(m)\right]$$

First, we have that for a given m, the payoff of an honest seller in business is strictly positive with the individual incentive compatibility condition (eq. 2.10).

Proof: we need to show that $[pm - c(m)] > 0$. According to (eq. 2.10),

$$[pm - c(m)] = \left[\frac{r+q_2+a}{q_2-q_1} - 1\right] c(m) > 0$$

Since

$$r + q_2 + a - (q_2 - q_1) = r + a + q_1 > 0$$

and $q_2 > q_1$.

Second, we need to see which m is profit maximizing for an honest seller, behaving competitively.

Proof: differentiating $G_{BH}$ with respect to m, we have

$$\frac{\partial}{\partial m}G_{BH} = \frac{1+r}{r}\frac{r+a}{r+a+q_1}\left[p - c'(m)\right]$$

$$\frac{\partial^2}{\partial m^2}G_{BH} = -\frac{1+r}{r}\frac{r+a}{r+a+q_1}c''(m)$$

Case 1: if $c''(m) = \delta_2 = 0$

$$\left[p - c'(m)\right] = \frac{r+q_2+a}{q_2-q_1}\delta_1 - \delta_1 = \left[\frac{r+q_2+a}{q_2-q_1} - 1\right]\delta_1 > 0$$

In this case, any given positive m is profit maximizing.

Case 2: if $c''(m) = \delta_2 < 0$

$$p - c'(m) = \frac{r + q_2 + a}{q_2 - q_1}\frac{c(m^*)}{m^*} - c'(m)$$

$$= \frac{r + q_2 + a}{q_2 - q_1}\left(\delta_1 + \frac{1}{2}\delta_2 m^*\right) - (\delta_1 + \delta_2 m)$$

$$= \frac{r + q_2 + a}{q_2 - q_1}\delta_1 + \frac{\delta_2}{q_2 - q_1}\left\{\frac{1}{2}(r + q_2 + a)m^* - (q_2 - q_1)m\right\}$$

where $m^*$ is given to the seller.

If the seller's choice of m is greater than or equal to $\frac{(r+q_2+a)m^*}{2(q_2-q_1)}$, then $p - c'(m) \geq 0$. Since $G_{BH}$ is convex with $\delta_2 < 0$, setting $m = m^*$ is profit maximizing.

Case 3: if $c''(m) = \delta_2 > 0$.

In this case, if the seller's choice of m is less than or equal to $\frac{(r+q_2+a)m^*}{2(q_2-q_1)}$, then $p - c'(m) \geq 0$. Since $G_{BH}$ is concave with $\delta_2 > 0$, setting $m = m^*$ is profit maximizing.

If the seller's choice of m is greater than $\frac{(r+q_2+a)m^*}{2(q_2-q_1)}$, then an interior solution is theoretically possible. That is, the seller will fix only $m$ ($m < m^*$) cars even though he is given $m^*$ used cars. Yet such mixed strategy is not superior to the pure strategy when he's not fixing any cars before selling them.

**BIBLIOGRAPHY**


Akerlof, George A., "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism," The Quarterly Journal of Economics, August 1970, 84, pp. 488-500

Bond, Eric W., "A Direct Test of the "Lemons" Model: The Market for Used Pickup Trucks," The American Economic Review, Vol. 72, September 1982, pp. 836-840

Chezum, Brian and Wimmer, Brad, "Roses and Lemons: Adverse Selection in the Market for Thoroughbred Yearlings," The Review of Economics and Statistics, August 1997, Vol. 79, pp. 521-526

Crocker, Keith J. and Snow Arthur, "The Social Value of Hidden information in Adverse Selection Economies," Journal of Public Economics, Vol. 48, 1992, pp. 317-347

Heinkel, Robert, "Uncertain Product Quality: The Market for Lemons with an Imperfect Testing Technology," The Bell journal of Economics, Vol. 12, Autumn 1981, pp. 625-636

Kessler, Anke S., "The Value of Ignorance," The RAND Journal of Economics, Vol.29, Summer 1998, pp.339-354

Levin, Jonathan, "Information and the Market for Lemons," The RAND Journal of Economics, Vol.32, Winter 2001, pp. 657-666

Pratt, Michael D. and Hoffer, George E., "A Direct Test of the "Lemons" Model: comment," The American Economic Review, Vol. 74, September 1984, pp. 798-800