

Reputations in Markets With Asymmetric Information: A Classroom Game

James R. Wolf Jr. and Mark A. Myerscough

Abstract: The authors describe a classroom game used to teach students about the impact of reputations in markets with asymmetric information. The game is an extension of Holt and Sherman's lemons market game and simulates a market under three information conditions. In the full information setting, all participants know both the quality and the price of the items for sale. In the second setting, sellers have better quality information than buyers. In the third setting, sellers maintain their information advantage, but buyers may post feedback on the sellers' performance. The posted feedback generally increases buyer trust and disciplines sellers, resulting in higher levels of trade and higher average product quality. The game can be completed in one class period and includes discussion questions.

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Although several characteristics of electronic markets serve to facilitate trade, online transactions also involve greater uncertainty and increased opportunities for fraud. Unlike buyers in traditional settings, online shoppers are often physically unable to inspect the products for sale and typically must rely on pictures and descriptions provided by the seller. Any time buyers cannot determine the quality of a product until after the purchase has been made, sellers have less incentive to provide high-quality products. As a result, buyers will be unwilling to pay a quality premium, and the average quality in the market will decline. Unchecked, this quality uncertainty has the potential to add inefficiencies to online markets or even lead to their collapse.

Akerlof (1970) cited numerous institutions and practices employed to counteract the effects of quality uncertainty. He noted that repeated interaction with a trading partner and legal measures (i.e., contracting) are two methods that foster the trust needed to conduct trade. Akerlof also noted that guarantees, brand names, and licensing can counteract the effects of quality uncertainty. Each of these methods has the ability to enhance a merchant's reputation, and researchers have long known the economic impact of a firm's reputation. For example, Klein and Leffler (1981)

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and Shapiro (1983) both showed that favorable reputations give firms the ability to charge premium prices.

One way that electronic marketplaces, such as eBay, have attempted to reduce fraud and instill buyer trust is by allowing participants to post feedback about their experiences. Reputation systems allow buyers and sellers to rate each other, helping foster the trust needed to conduct online transactions. As a result of several online marketplace successes (and the suspected role that feedback systems play in these successes), trust and online reputation systems have become significant areas of research in both information systems (e.g., Ba and Pavlou 2002; Dellarocas 2003; Resnick et al. 2000) and economics (e.g., Reiley 2006; Cabral and Hortagaçu 2004; Houser and Wooders 2006). Ba and Pavlou found that online feedback ratings influence buyer trust, which, in turn, affects the price premium that sellers receive. Similarly, Reiley and Houser and Wooders found evidence of connections between an online auction seller's reputation and the price premium received. In studies closely related to this work, Dewan and Hsu (2004) and Wolf and Muhanna (2005) found that seller reputations help mitigate the effects of quality uncertainty in online markets.

We describe a classroom game used to teach students about reputation systems in markets such as eBay and others found online where sellers have better product quality information than buyers. In these environments, the addition of a buyer-feedback mechanism typically increases buyer trust and serves as a regulatory influence on sellers.

THE GAME

This game is a slight extension of Holt and Sherman's (1999) lemons market game and can be completed in a single class period. In this game, students buy and sell hypothetical commodities in three distinct informational settings. The structure of supply and demand is determined by the sellers' cost and the buyers' value for each product. These costs and values are listed on the buyers' and sellers' instruction sheets. For simplicity, buyers have identical valuations, and sellers have identical costs. Each seller can produce at most two units of items per round. The grade of both items must be the same, and the cost of producing the second item is \$1 higher than the cost of the first unit. For this reason, sellers have the option of refusing to sell their second unit. However, we have run the game several times and our students have never chosen this option. The production costs for all three quality grades are displayed in Table 1. In addition, each buyer may purchase at

TABLE 1. Seller's Cost of Production (Provided Only to Sellers)

	Grade 1	Grade 2	Grade 3
Seller's cost of 1st unit	\$1.40	\$4.60	\$11.00
Sellers' cost of 2nd unit	\$2.40	\$5.60	\$12.00

most one item per round, and the value of the item to the buyer is determined by the product's grade (details are listed in Table 2).

Buyers earn money by making a purchase at a price that is below their realized value (see Table 2), which depends on the quality grade. The specific realized values are supplied only to the buyers. The value to the buyer depends only on the product grade, not on whether it is the seller's first or second unit in the period. A buyer's earnings are calculated as the difference between the value and the purchase price (i.e., buyer earnings = realized value for grade purchased – seller's price). If a buyer does not make a purchase, the buyer earns \$0 for the round. It is possible for a buyer to "lose" money on a purchase.

Similarly, sellers earn money by making one or more sales at a price that is above the cost of the unit (determined from Table 1). A seller's earnings are calculated as the sum of the earnings on the units actually sold (i.e., seller earnings = sale price – cost of grade produced). A seller who does not make a sale in a period will earn \$0 for the round. Tables 3 and 4 illustrate the income statement that results for buyers and sellers as the simulation progresses.

For example, if seller number 2 selects a grade of one and a price of \$3.00 and then sells one unit to buyer number 1, the seller's profit for the round would be \$1.60, and the buyer's profit for the round would be \$1.00. If in round two, seller number 2 again selects a grade of one and a price of \$3.00 but is now able to sell both items, both buyers would earn identical profits of \$1.00 for the round, and Seller 2's profits would be \$2.20. This result is shown in Table 4.

TABLE 2. Buyer's Realized Values (Provided only to Buyers)

	Grade 1	Grade 2	Grade 3
Buyer's value	\$4.00	\$8.80	\$13.60

TABLE 3. Example of Buyer 1's Earnings in Round 1

Period	1
A. ID of seller of product	2
B. Grade of product	1
C. Value to you (from table)	\$4.00
D. Purchase price	\$3.00
E. Period Earnings: (C – D)	\$1.00
F. Cumulative profit (E + Prev. F)	\$1.00

TABLE 4. Example of Seller 2's Profits After Round 2

Period	1	2
A. Grade for current period	1	1
B. Price for current period	\$3.00	\$3.00
C. Sales price on 1st unit	\$3.00	\$3.00
D. Cost of 1st unit	\$1.40	\$1.40
E. Profit on 1st unit (C – D)	\$1.60	\$1.60
F. Sales price on 2nd unit	NA	\$3.00
G. Cost of 2nd unit	NA	\$2.40
H. Profit on 2nd unit: (F – G)	NA	\$0.60
I. Total profit for period: (E + H)	\$1.60	\$2.20
J. Cumulative profit (I + Prev. J)	\$1.60	\$3.80

**TABLE 5. Public Commodity Table
(Publicly Displayed)**

Seller	Price	Grade	Item	Feedback
1	\$		1, 2	
2	\$		1, 2	
3	\$		1, 2	

We have found that the game can be run successfully in a 50-minute period but that it works better in longer sessions. Before the class begins, we create a table on a whiteboard that includes a row for each seller (group or individual, depending on class size), with columns for identifying the sellers, the sellers' prices, and the grades of their items. We also include an items column. This makes it easy to represent the sale of a seller's item by drawing a line through the item number, signaling the other buyers that the item is no longer available. There is also space for buyer feedback, which is used in later rounds. We show an example of the table (Table 5) prior to the beginning of a full information round.

Next, we assign students roles as sellers or buyers and distribute the game's instruction and record sheets. The instruction and record sheets for both groups are taken nearly verbatim from Holt and Sherman (1999) and can be found in Appendixes A (sellers) and B (buyers). For large classes, they recommended using teams or having a portion of the class observe while others participate. Because our classes normally contain 25 or fewer students, we have not had an opportunity to try observers. However, we have conducted the game several times with groups of 2 or 3 students working together as a single buyer or seller team and found that it works well. To avoid excessive delays in processing the purchase rounds, Holt and

Sherman suggested three seller groups and four buyer groups. We have found that the game works better if each team sits together with buyers and sellers separated. This allows team members to work together, prevents communication between groups, and lowers the possibility of one group overhearing the deliberations of another.

Prior to beginning the experiment, the instructor or an assistant reads the common portion of the instructions to all participants. It is important that the reader takes care not to publicly reveal either the sellers' costs or the buyers' values at this time. After reading the instructions, the instructor should allow a short amount of time for questions, but we have found that conducting a practice round is often quicker and more helpful than a prolonged question-and-answer session. We created an extra column on both the buyers' and the sellers' record sheets for the practice round.

Before each round begins, each seller or seller team chooses a quality grade and price for that period. These selections are based on the cost values included in Table 2, which are provided solely to the sellers. In the early "full information" rounds, once the sellers have chosen a grade and a price for the round, this information is entered into the public commodity table (Table 1) that is, accessible by all participants. We have found that it is helpful to provide sellers with extra copies of the worksheet and have them record their grade and price selections and then submit the extra forms to the instructor or assistant. This allows the games to move quickly and forces sellers to set their prices simultaneously and independently.

Next, the first buyer must be identified. Holt and Sherman suggested drawing lots. We have found that using a simple rotation, allowing group one to go first in round one and group two in the next one, rotating through the groups each subsequent round also works. No matter which method is chosen, the key issue is the students' perception that the process is fair. If you are paying students or providing some other reward based on performance in the game, it is also important that you choose a method that does not bias the game in favor of one group over another.

Taking turns, buyers have an opportunity either to choose which seller to purchase from or to skip purchasing for the round. As buyers make purchases, we identify the purchase on the appropriate seller's row by drawing a line through the corresponding number in the Item column; this lets other buyers know which items are no longer available. After all buyers have finished, we ask buyers and sellers to calculate their profits and earnings for the round and ask sellers to choose their grades, prices, quantities for the next round.

After a few rounds, when it appears that the market is working well, we announce a change in the rules of the game. Holt and Sherman noted that sometimes the market will have settled at the optimal grade by the second round and that it should have settled by the fourth round. After the change, sellers will select a grade and price, just as before, however, for the remaining rounds, only the price will be posted for buyers to see. In the rounds with information asymmetry, buyers are not told the grades of the products until the end of the round. The change in game rules should be made before the sellers choose grades and prices for the next

round. Holt and Sherman point out that they try to announce the changes with a straight face so they do not alert the students to the new possibilities for sellers to take advantage of buyers. However, each time we have run the game, the students immediately picked up on the possibilities for mischief. Holt and Sherman found that, under the new rules, two rounds usually establish equilibrium at the lowest quality level (1), which they noted is not the socially optimal outcome. However, we found that under the new trading rules, economic exchanges actually stopped or were severely diminished at least for a round or two, as buyers were reluctant to risk purchasing any item with a price exceeding their value for the lowest quality level.

Once sellers have settled on a grade of one (or it is readily apparent that trading is severely diminished), we announce a final change in the game's rules. Sellers will continue to select both grades and prices, with only the prices being posted. However, now, at the end of the round, when the product grades are provided to buyers, buyers are given an opportunity to provide feedback on the sellers. If the buyer feels that the seller posted a fair price, the seller is given a smiley face (☺), and if the buyer feels that the seller posted an unfair price, the seller is given a sad face (☹). Previously, we used plus symbols (+) to denote positive feedback and minus symbols (−) to denote negative feedback, but we have found that the students generally prefer the smiley face. In fact, students who feel that they have been especially cheated often ask if they can add tears or horns to the figures. In a recent session, one student group added steam coming out of the ears of their figure. The feedback marks for each seller remain on the board for the remainder of the game. We find that under this new set of rules (the feedback rounds) that the number of trades quickly improves and that sellers are able to sell higher quality items.

At the conclusion of the game, total buyer and seller profits for each round are calculated and any payment or reward, if part of the game, is distributed. There has been a great deal of discussion about the appropriate incentives to encourage students to take a classroom game seriously. We have found that providing a small payment or reward (e.g., a mug or a candy bar) to the buyers and sellers with the highest earnings works well. In addition, given the competitive nature of our students, we have found that the desire to beat their classmates or bragging rights is also a powerful motivator. Finally, students are assigned the following six follow-up questions:

1. What happened in the full information setting?
2. What happened in the information asymmetry setting?
3. What happened in the feedback setting?
4. How did the feedback affect buyers in our exercise?
5. How did the feedback affect sellers in our exercise?
6. Several people have credited, at least partially, eBay's success to the online auctioneer's feedback system. What do you think of this claim?

We normally instruct the students to answer the questions and to be prepared to discuss them in the next class meeting.

DISCUSSION

Although we have had success with this exercise in a number of different courses, for our discussion here, we describe the results of games run in two undergraduate information systems (IS) classes. In both classes, the game proceeded as expected, with high trade levels and high profits for both buyers and sellers in the full information setting. This was followed by reduced trading and reduced profits in the rounds with information asymmetry rounds. In fact, trading was nearly halted for the two rounds of asymmetric trading, as sellers attempted to continue to sell higher priced (and therefore higher profitability) items, whereas buyers were reluctant to purchase anything priced above their value for the lowest quality level. In the rounds with buyer feedback, we saw improved trading and profits for both buyers and sellers. The complete results for the classroom trading exercises are included in Appendixes C and D.

From our students' written answers to the follow-up questions and their comments in the class discussions that followed, students participating in the exercise appeared to have gained a solid understanding of the potential problems inherent in markets with information asymmetry and the possible role that reputations can play in mitigating those problems.

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APPENDIX A
SELLER INSTRUCTIONS AND PROFIT TABLES

Seller Instructions for Seller Number _____

This is a market with buyers and sellers. The sellers will begin by choosing a price and a quality “grade.” My assistant and I will collect these decisions and write them on the whiteboard. Then we will give buyers the chance to purchase from one of the sellers at the grade and price listed. The grade can be any number from 1 to 3; a higher grade costs more to produce and is worth more to buyers. The table below shows your costs of producing the different grades for a seller. (The buyers receive a similar table showing the realized value of each product grade, although their value is not affected by first or second unit considerations)

	Grade 1	Grade 2	Grade 3
Seller’s cost of first unit	\$1.40	\$4.60	\$11.00
Seller’s cost of second unit	\$2.40	\$5.60	\$12.00

Each buyer can buy only 1 “unit” of the commodity during a period. Each seller can sell up to two units in a period, but the second unit costs \$1 more to produce. If you are a seller, the top row of the table above shows the cost of the first unit that you actually sell in a period (for the grade you choose); the second unit costs \$1 more than the first unit. Unsold units are not actually produced and hence incur no cost.

Buyers earn money by making a purchase at a price that is below their realized value, which depends on the quality grade. The realized value to the buyer depends only on the grade, not on whether it is the seller’s first or second unit in the period. A buyer’s earnings are calculated as the difference between the value and the purchase price:

$$\text{Buyer earnings} = \text{Value for grade purchased} - \text{Seller’s price.}$$

If a buyer does not make a purchase, the buyer earns \$0.

Sellers earn money by making one or more sales at a price that is above the cost of the unit (determined from the table above). A seller’s earnings are calculated as the sum of the earnings on the units actually sold:

$$\text{Seller earnings} = \text{Sale price} - \text{Cost of grade produced.}$$

A seller who does not make a sale in a period will earn \$0.

When all sellers have finished choosing their prices and grades for the period, we will collect these sheets and write the prices and grades on the whiteboard under the seller numbers. Then I will draw lots to determine a buyer number, and that buyer can purchase a unit from one of the sellers or from no seller.

Buyers are then chosen in order; if buyer 2 goes first, then buyer 3 is second, . . . and buyer 1 is last. Once a seller has sold a unit, I will draw a line through that seller’s number 1 in the Items column. Note, the second unit costs \$1 more for the seller to produce, so the seller will be asked whether or not the seller wishes to sell a second unit at the advertised price and grade. If a second unit is sold, it must be at the same price and grade as the first unit. If a seller refuses to sell the second unit or sells both units in a period, I will draw a line through that seller’s number 2 in the Items column.

You can use the attached table to calculate (hypothetical) earnings. Are there any questions?

We will begin by having each seller choose a price and quality grade for our practice round. Sellers should write these two items in rows A and B of your profit record table. Remember; do not include the profits from this practice round in your cumulative profit (Row J) or your total profit for the game.

TABLE A1. Seller's Profits

Income/cost element	Activity round										
	Practice*	1	2	3	4	5	6	7	8	9	10
A. Product grade for period											
B. Price for current period											
C. Sales price on 1st unit											
D. Cost of 1st unit											
E. Profit on 1st unit (C – D)											
F. Sales price on 2nd unit											
G. Cost of 2nd unit											
H. Profit on 2nd unit (F – G)											
I. Total profit for period (E + H)											
J. Cumulative profit (I + Prev J)											

*Do not include the practice round in your cumulative profit (Row J) or your total profit for the game.

Income/cost element	Activity round									
	11	12	13	14	15	16	17	18	19	20
A. Product grade for period										
B. Price for current period										
C. Sales price on 1st unit										
D. Cost of 1st unit										
E. Profit on 1st unit (C – D)										
F. Sales price on 2nd unit										
G. Cost of 2nd unit										
H. Profit on 2nd unit (F – G)										
I. Total profit for period (E + H)										
J. Cumulative profit (I + Prev J)										

APPENDIX B

BUYER INSTRUCTIONS AND EARNINGS TABLE

Buyer Instructions for Buyer Number _____

This is a market with buyers and sellers. The sellers will begin by choosing a price and a quality "grade." My assistant and I will collect these decisions and place them on the public display. Then we will give buyers the chance to purchase from one of the sellers at the grade and price listed. The grade can be any number from 1 to 3; a higher grade costs more to produce and is worth more to buyers. The table below shows you the realized value you receive for each of the three grades. The sellers have received a similar table, which identifies the costs associated with producing the products for each of these three grades. One difference is that the sellers incur an additional cost for increasing their production, meaning that their cost for selling a second unit at the identical grade level is higher.

	Grade 1	Grade 2	Grade 3
Buyer value	\$4.00	\$8.80	\$13.60

Each buyer can buy only 1 “unit” of the commodity during a period. Each seller can sell up to two units in a period, but the second unit costs \$1 more to produce.

Buyers earn money by making a purchase at a price that is below the realized value, which is dependent on the quality grade. The value to the buyer depends only on the grade, not on whether it is the seller’s first or second unit in the period. A buyer’s earnings are calculated as the difference between the value and the purchase price:

$$\text{Buyer earnings} = \text{Value for grade purchased} - \text{Seller's price.}$$

If a buyer does not make a purchase, the buyer earns \$0.

Sellers earn money by making one or more sales at a price that is above the cost of the unit (determined from their cost of production table). A seller’s earnings are calculated as the sum of the earnings on the units actually sold:

$$\text{Seller earnings} = \text{Sale price} - \text{Cost of grade produced.}$$

A seller who does not make a sale in a period will earn \$0.

When all sellers have finished choosing their prices and grades for the period, we will collect these sheets and write the prices and grades on the whiteboard under the seller numbers. Then I will draw lots to determine a buyer number, and that buyer can purchase a unit from one of the sellers or from no seller.

Buyers are then chosen in order; if buyer 2 goes first, then buyer 3 is second, . . . and buyer 1 is last. Once a seller has sold a unit, I will draw a line through that seller’s number 1 in the Items column. Note, the second unit costs \$1 more for the seller to produce, so the seller will be asked whether or not the seller wishes to sell a second unit at the advertised price and grade. If a second unit is sold, it must be at the same price and grade as the 1st unit. If a seller refuses to sell the second unit or sells both units in a period, I will draw a line through that seller’s number 2 in the Items column.

You can use the attached table to calculate (hypothetical) earnings. Are there any questions?

We will begin by having each seller choose a price and quality grade for our practice round. Sellers should write these two items in rows A and B of your profit record table. Remember; do not include the profits from this practice round in your cumulative earnings (Row F) or your earnings for the game.

Income/cost element	Activity round										
	Practice*	1	2	3	4	5	6	7	8	9	10
A. ID of seller of product											
B. Grade of product											
C. Value to you (from table)											
D. Purchase price											
E. Period earnings: (C – D)											
F. Cumulative earnings (E + Prev. F)											

*Do not include the practice round in your cumulative earnings (Row F) or your total earnings for the game.

Income/cost element	Activity round									
	11	12	13	14	15	16	17	18	19	20
A. ID of seller of product										
B. Grade of product										
C. Value to you (from table)										
D. Purchase price										
E. Period earnings: (C – D)										
F. Cumulative profit (E + Prev. F)										

APPENDIX C RESULTS FOR CLASS 1

Buyer Earnings per Round									
	Full information rounds				Information asymmetry		Feedback used		Total
	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	
	Buyer 1	\$3.20	\$0.00	\$1.70	\$1.81	-\$2.00	\$2.30	\$2.31	
Buyer 2	\$3.20	\$0.00	\$2.31	\$1.81	\$0.00	\$0.00	\$0.50	\$0.50	\$8.32
Buyer 3	\$1.55	\$0.10	\$2.31	\$2.00	-\$3.00	\$0.00	\$0.50	\$0.75	\$4.21
Buyer 4	\$1.55	\$0.10	\$1.70	\$2.00	\$0.00	\$0.00	\$2.31	\$0.75	\$8.41
All	\$9.50	\$0.20	\$8.02	\$7.62	-\$5.00	\$2.30	\$5.62	\$2.51	\$30.77

*Best group performance.

Sellers' Profits per Round									
	Full information rounds				Information asymmetry		Feedback used		Total
	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	
	Seller 1	\$1.00	\$0.00	\$2.78	\$3.78	\$4.60	\$0.00	\$2.78	
Seller 2	\$4.30	\$4.00	\$0.00	\$0.00	\$0.00	\$1.90	\$3.20	\$2.10	\$15.50
Seller 3	\$0.00	\$2.60	\$4.00	\$3.40	\$0.00	\$10.20	\$0.00	\$2.70	\$22.90*
All	\$5.30	\$6.60	\$6.78	\$7.18	\$4.60	\$12.10	\$5.98	\$11.89	\$60.43

*Best group performance.

Items Sold

	Full information rounds				Information asymmetry		Feedback used		Total
	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	
	High grade (3)		2						
Medium grade (2)	4		4	4		1	2		15
Low grade (1)		1			2		2	4	9
All	4	3	4	4	2	1	4	4	26

APPENDIX D RESULTS FOR CLASS 2

Buyer Earnings per Round

	Full information rounds				Information asymmetry		Feedback used		Total
	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	
	Buyer 1	\$0.30	\$0.00	\$1.20	\$1.60	\$0.60	\$0.00	\$0.20	
Buyer 2	\$2.80	\$0.55	\$0.00	\$0.50	\$0.90	\$0.00	\$1.30	\$0.00	\$6.05
Buyer 3	\$2.80	\$0.55	\$1.20	\$0.50	\$0.50	\$0.00	\$1.30	\$1.60	\$8.45*
Buyer 4	\$0.30	\$0.00	\$1.20	-\$2.40	\$0.50	\$2.00	\$0.30	\$1.60	\$3.50
Buyer 5	\$0.00	\$0.00	\$1.20	-\$1.40	\$0.60	\$0.00	\$0.20	\$0.80	\$1.40
All	\$6.20	\$1.10	\$4.80	-\$1.20	\$3.10	\$2.00	\$3.30	\$4.00	\$23.30

*Best group performance.

Sellers' Profits per Round

	Full information rounds				Information asymmetry		Feedback used		Total
	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	
	Seller 1	\$2.90	\$2.65	\$0.00	\$1.10	\$0.00	\$0.00	\$0.00	
Seller 2	\$1.80	\$0.00	\$5.00	\$9.00	\$3.00	\$0.00	\$7.00	\$8.00	\$33.80*
Seller 3	\$0.00	\$2.60	\$5.00	\$2.60	\$3.20	\$2.20	\$4.80	\$0.00	\$20.40
All	\$4.70	\$5.25	\$10.00	\$12.70	\$6.20	\$2.20	\$11.80	\$8.00	\$60.85

*Best group performance.

Items Sold

	Full information rounds				Information asymmetry		Feedback used		Total
	<i>Round 1</i>	<i>Round 2</i>	<i>Round 3</i>	<i>Round 4</i>	<i>Round 5</i>	<i>Round 6</i>	<i>Round 7</i>	<i>Round 8</i>	
	High grade (3)							2	
Medium grade (2)	4	2	4	1		1	5	1	18
Low grade (1)		1		4	5				10
All	4	3	4	5	5	1	5	3	30