

BEM 103

10-14 Class 5: Asymmetric Information

Class 5: Asymmetric Information

**The market for lemons and the
winner's curse. Efficient market
Information aggregation**

Information

- Competitive market
 - Why do actor's (buyers and sellers) have an impact on price?
 - Because they are large (they 'move' the supply or demand curve)
 - Because they have information and other actors care about that information.
- Definitions
 - Private value
 - When each individual has a different value for the asset.
 - Common value
 - When every individual has the same value for the object
 - These values may be known or no known
 - Private information
 - Knowledge that a individual or a group of individual has that others do not have.
 - Public information
 - What everybody knows
 - Private information is just stuff that you know that others do not know you know, its stuff that you know that others do not know.

Efficient markets and private information

- The axioms of modern finance hold *only* if there is complete information aggregation.
- Efficiency require that only prices matter to decisions
- But there is asymmetric information
 - Some information arrives sooner to some people than other (insiders)
 - Some people have a close experience of the asset at hand
 - Some people make “discoveries” of information
- But if markets are efficient this all gets revealed

Problems of asymmetric information

- Insider trading
 - Martha Stewart
 - SAC
- Market for lemons
 - Closing of the Neumarkt (German Nasdaq)
 - Shut down of IPO market in 2002 and 2003
 - Need for solution (rating agencies?)
- Winner's curse
- Cascades

Market for Lemon Pt 1

Firm Value	Probabilities	
	Good Firm	Bad Firm
100	0.5	0
50	0.5	0.5
0	0	0.5

Suppose that the good and bad firm are equally likely

Then the expected value of investing blind is

$$V = 0.5(0.5 \cdot 100 + 0.5 \cdot 50) + 0.5(0.5 \cdot 50) = 50$$

What is the value of information?

The expected return from investing in good firms is

$$V_g = 0.5 \cdot 100 + 0.5 \cdot 50 = 75$$

The expected return from investing in bad firms is

$$V_b = 0.5 \cdot 50 = 25$$

Who has the information

- Issuer does
- Consider the good firm
 - It can raise \$50 but it has to pay \$75 in expected value.
 - It has other choices
- Use bonds?
 - That won't work because it will have to pay a risk premium (because the bad firm won't borrow)
- Stay away from capital markets and use retained earnings
 - That might slow growth but it may be cheaper
 - How

Market for Lemon Pt 1

Firm lives for two periods and is either good or bad

Firm has a gross return on capital of ak up to $k=100$ and 0 afterwards
interest rate is 5%. The firm already has 50\$ in capital.

If firm fully funded at period 1,

$$NPV = -k + ak(1/1.05 + 1/(1.05)^2) = k(a(1.86) - 1)$$

	Probabilities		
	Good Firm	Bad Firm	Both
Period	2k	0.4k	1.2
NPV	2.71k	-0.07K	1.23

Suppose investors can't tell the good and the bad firms apart

Then what is the price of equity if each type of firm is equally likely

The NPV is now 1.23k so the cost of raising \$50 is 40.7% of the equity of the firm.

The good firm

The good firm's founder can do an IPO or used retained earnings to grow the firm

If IPO, she retain 59.4% of the firm and with $k=100$ $a=2$ per period return is 118.7. Discounting gives the NPV

But the good firm does not have to go to IPO, it can wait for retained earnings to accumulate

No IPO then K_1 is 50 and then reinvested and returns change

	Period 1 return	Period 2 return	Founder NPV	
IPO	118.8	118.8	220.8	$K_1=k_2=100$
Retained earnings	50.0	200.0	229.0	$K_1=50, K_2=100$
IPO, No A. Info	126.4	126.4	235.1	$K_1=k_2=100$

So the good firm stays out of the market

The bad firm

- The bad firm's founder has same choice
- If IPO, she retains 59.4% of the firm and with $k=100$ $a=0.4$ per period return is 23.7. Discounting gives NPV (50 investment is sunk)
- No IPO then $K_1=k_2$ is 50 per period return is 20
- So strictly want to go to the market.

	Period 1 return	Period 2 return	Founder NPV	
IPO	23.7	23.7	44.2	$K_1=k_2=100$
Retained earnings	20.0	20.0	37.18	$K_1=50, K_2=50$

- Now what do investors infer: that only bad firms are in market
- Suppose the firm is fully funded ($k=100$) with $a=0.4$, income is 40. there is no equity level that would persuade investors to commit
- MARKET FAILS

Aggregate returns

- With IPO the capital of 100 gives an expected Return $220(0.5)+40(0.5)=130$
- With no IPO the ER is $0.5*(229)+0.5*(37)=133$
- So in this case society is better off without the capital market
- If no A. Information $0.5*235+0.5*37=136$
- Can the good firm 'pull' away from the bad firm.
- Solution: debt
 - Investor offers debt contract: \$50 at 5% per period. In case of insolvency the firm passes to the investor
 - Bad firm is insolvent at period 2, so returns to founder are $15/1.05 < \text{returns to no IPO}=37$
 - Good firms are solvent and pay interest so returns are same as the No IA case 235.
- Other solutions?

The lemons problem reconsidered

- The lemon (bad) firm wants to look like the good firm (pool), because it then gets a subsidy
- The good firm wants to look very different from the bad firm (separate) because then it does not pay the subsidy.
- Financial structure can help
- Is this a violation of Modigliani Miller?

Solutions to the lemon's problem

- Sellers have a credible signal of the “quality” of the assets they are selling
 - Then general unraveling results
 - The best firms what to reveal the signal
 - Then the next best firms....
 - So buyers become informed
- Firms do not have credible signal
 - Incentive for best firms to differentiate themselves is large
 - So they may want to bear costs to do so

Winner's curse

- For this exercise ignore discounting
 - Otherwise multiply all payoffs by d .
- Suppose we are marketing m units of security that again will a high return of 2 with probability $\frac{1}{2}$ and a low return of 1 with probability 1.
 - High and low are 'states of the world'
- If no one knows anything else and is risk neutral price is 1.5.
- If we knew that the return was going to be high, the price would be 2 (or 1 if low)
- But we don't.

Signals

- There are n potential investors and each receives a signal of the likely state of the world
- The signal is imperfect but informative.
- $P_G^H = P_B^L > 0.5 > P_G^L = P_B^H = (1 - P_G^H) = (1 - P_B^L)$
- Signals are more often right than wrong but some people get the signal wrong
- Ignore indivisibilities and let the number of people with the good signal when the state is high be nP_G^H
- At the same time there must also be $n(1 - P_G^H)$ individuals with a bad signal. This signal it turns out is wrong.

Are signals enough for efficiency

- Suppose people are 'naïve' and just bid high when the signal is good and low when the signal is bad
- So there will be nP_G^H high bids and $n(1 - P_G^H)$ low one. If each bidder buys 1 share and the price is fixed at highest unfilled bid.
- What prices will prevails?
 - If the number of shares $m < n(1 - P_G^H)$ then $P = b^H$.
 - if the number of shares $m > n(P_G^H)$ then $P = b^L$.
- If the number of shares $n(1 - P_G^H) < m < n(P_G^H)$ then signals are used in an informative way.
 - In the high state there are $n(P_G^H)$ good signals thus the marginal bid will be high and equal to 2.
 - In the B low there are $n(P_G^H)$ low signals marginal $b^L = 1$.

Can you ignore the market

- When the market is informative might as well bid your value.
- When the market is not informative
 - Could you do better by bidding the expected value conditional on your signal?
 - If your signal is good it is right with probability P_G^H and wrong with probability $(1 - P_G^H)$ so the expected value conditional on a good signal is $2 P_G^H + (1 - P_G^H) = 1 + P_G^H$
 - If your signal is bad it is right with probability P_B^L and wrong with probability $(1 - P_B^L)$ so the expected value conditional on a Bad signal is $P_B^L + 2(1 - P_B^L) = 2 - P_B^L = 2 - P_G^H$
 - $P_G^H > 0.5 \Rightarrow 1 + P_G^H > 2 - P_G^H$
 - Are these bids equilibrium bids?
 - What is missing is that you do not get the item for sure if you get the good signal

The market rules

- Well if all high bidders use these and there is an excess of high bidders ($m < n(1 - P_G^H)$)
 - You never get the item when you bid low (your signal is bad) because there is an excess of high bidders
 - You get the good signal and the state is high with probability P_G^H then get the item with probability m/nP_G^H so the probability you get the item in a good state is simply m/n .
 - You get the good signal and the state is low with probability $1 - P_G^H$ and then get the item with probability $m/n(1 - P_G^H)$ so the probability you get the item in a bad state is simply m/n .
 - $EV = (2 - 1 - P_G^H)m/n + (1 - 1 - P_G^H)m/n = (1 - 2P_G^H)m/n < 0$
- Not a symmetric strategy equilibrium. In fact the only one possible is $B=1.5$

Excess low bids

- Suppose there is an excess of low bidders ($m > nP_G^H$)
 - Consider someone with a good signal who wants to bid $1 + P_G^H$.
Because there is an excess of low bidders $p < 1.5$
 - You get the good signal and the state is high with probability P_G^H then get the item with probability 1 so the probability you get the item in a good state is simply P_G^H .
 - You get the good signal and the state is low with probability $1 - P_G^H$ and then get the item with probability 1 so the probability you get the item in a bad state is simply $(1 - P_G^H)$.
 - $EV = (2 - p) P_G^H + (1 - p) (1 - P_G^H) = 2P_G^H - pP_G^H + 1 - P_G^H - p + pP_G^H = 1 + P_G^H - p$.
Because there is an excess of low bidders $p < 1.5$ so people who get a good signal have an incentive to deviate from p .
- Does this bidding reveal the state?
 - Given n , the number of bids greater than $p > 1.5$ reveals the state but this information may never arrive to those who got the low signal (suppose the rules are sealed bid)

Naïve and strategic bids

- If the signal-bid process is informative then being naïve is fine (because the market is efficient)
- If $m < n(1 - P_G^H)$ and $P = b^H$.
- What sets b^H ?
- Well if people are naïve $b^H = 2$ then there is a winner's curse.
 - Why?
- So right $P = b^H = 1.5$

Private information

- Notice that if signals are not informative everyone bids 1.5 (so the allocation is a lottery over every body).
- If signals are informative then the allocation is a lottery over people who go the right signal.
- With two outcomes that is as far as you can go.
- With more signals.
 - Same logic applies because in setting your bid you worry about both the information you have and the information others have.

Informational cascade

- Individuals wake up a different times.
- They have two pieces of information, yesterday's close and the current price.
- The first person who wakes up gets a signal (idea) and decides to buy or sell or do nothing. He then goes to work (he does not have the option to wait)
- The second person to wake up sees the two data points and if the price rose she knows that the person before her had a positive idea. Now she must take into account her signal and the one that came before. If she had a positive signal the fact that the price rose reinforces it (and she is more likely to buy), if she got a negative signal the price rise dampens and she may well do nothing.
- The third person to wake up sees the two data points and if the price is high he knows that the average of the previous two signals is positive and so he will put even less weight on his signal than the people that came before him
- The n^{th} person sees the two data points and if the price is high she knows that the average of the previous signals was positive and just ignores her signal entirely (she takes the price information as a sufficient statistic)
- One that happens all future individuals ignore their signal.

10-16 Class 6: Pricing riskless Bonds

- **Net Present value, again;**
- **Fed policy and inflation;**
- **Expectations and the yield curve;**
- **Implication for assets with risk;**
- **Digression junk bonds and bankruptcy;**
- **Application: QE2 and the unwinding of the Fed Position.**