

Strategic Uses of Information 2

3. Signalling: Using an Informational Advantage

The ♂ red stag's antlers are almost useless in fighting, but...

A biological signal such as a pair of antlers actually must have a “cost”, or deleterious effect on viability, if it is to be taken seriously (by the doe ♀, the potential mate).

Furthermore, the cost must be one that stronger stags can pay more easily than their weaker brethren.

The cost or handicap is a *guarantee of the honesty* of the display.

If there were no cost, then there would be rampant cheating, and observers would quickly learn to ignore the false advertising. (A babbling equilibrium.)

Evolution produces cumbersome antlers because signalling to the ♀ an unmistakable message about the ♂'s superior constitution more than compensates for the aggravation, or cost, of supporting the antlers.

∴ Compare “costly signalling” with “cheap talk.”

Credibility?

If you have an incentive to exaggerate your own worth, how can you *credibly* convey your private information?

- ***An independent third party?***
If the information is truly private, this option may be unavailable.
- ***A reputation for honesty?***
A valuable asset, and recognised as such. But without the visibility or longevity in the market to develop such a reputation, unavailable.
- **How else?**

What if there is some action — *a signal* — that is costly to take and which is visible to the other party, which is more costly if lying than if telling the truth? Then the other party might see the action and infer truth telling.

Signalling unobserved attributes

Signals are a form of *credible communication*: putting one's money where one's mouth is; one's actions speak louder than words. Talk is cheap ...

... because supply exceeds demand. Clichés, but ...

***e.g. The job seeker.* Private information: you could do the job well if hired. Sufficient to tell the employer? Credentials as a signal, if harder to get for an incompetent worker than for a competent worker.**

***e.g. The would-be borrower.* Private information: you intend to repay the loan. Sufficient to tell the bank? A good credit record as a signal.**

When signalling cannot occur — when information cannot be credibly communicated — markets don't function well, and inefficiencies occur. (See the sub-prime mortgage crisis.)

An inefficient outcome: although possible (with complete information), mutually beneficial trade does *not* occur.

Signalling is not necessarily cost-effective.

Nor does the existence of a signalling method *ensure* that signalling occurs: a market equilibrium may occur in which no-one succeeds in signalling, or some, but not others, may be able to signal.

Signalling unobserved quality, not price.

Can sellers signal quality?

Reputation, third-party credentials.

For insurance, medical checks compulsory.

But limited elimination of informational asymmetries.

Credibly?

Countersignalling: Reverse Snobbery?

(Reading 28 on “Signal Failure” from the *Economist*):

The job market:

With three (not two) types, “countersignalling” (i.e., pretending to be less bright than they are) is a way that the Top types can distinguish themselves from the Middle types.

The Middle types will boast about their grades, to set themselves apart from the Low types.

The Top types know that their grades and references set themselves apart from the Low types...

And by playing cool about their grades, they separate themselves from the eager Middle types.

But now both Middle and Top types play cool ...

4. Education as a Signal

How could Sally signal her good car's quality?

Mike Spence, erstwhile dean of the Stanford GSB, shared the Nobel in 2001 for his research on signalling.

A *guarantee* or *warranty* is more costly for Sally selling a “lemon” than for selling a good car, and so can signal quality.

***Signals* can overcome informational frictions, to reduce inefficiencies, but not always, or not always efficiently.**

Potential employees can use their *training* or *education* as a signal, especially if training is more costly for less competent students ...

A worker's unobservable quality

Betty the boss wants to hire Wally the worker, but can't tell (private info) whether Wally is:

- highly productive (HP) or**
- less productive (LP) before hiring him.**
- HP workers are worth \$200 to Betty, LP workers are worth \$100.**
- Wally knows his worth. (& Betty knows Wally knows)**
- Competition from other employers forces Betty to pay the full amount of Wally's perceived worth at the time of hiring.**
- Wally can choose to receive education before trying for a job, and get a diploma.**
- Education has no effect on productivity, but is observed by Betty — an extreme (“credentialist”) view of education.**
- Assume that schooling costs a LP worker more than an HP worker: \$120 against \$60. Why? Extra tutoring, etc.**

Q: Can Wally's educational level credibly signal his innate worth?

A self-confirming Bayesian equilibrium in beliefs:

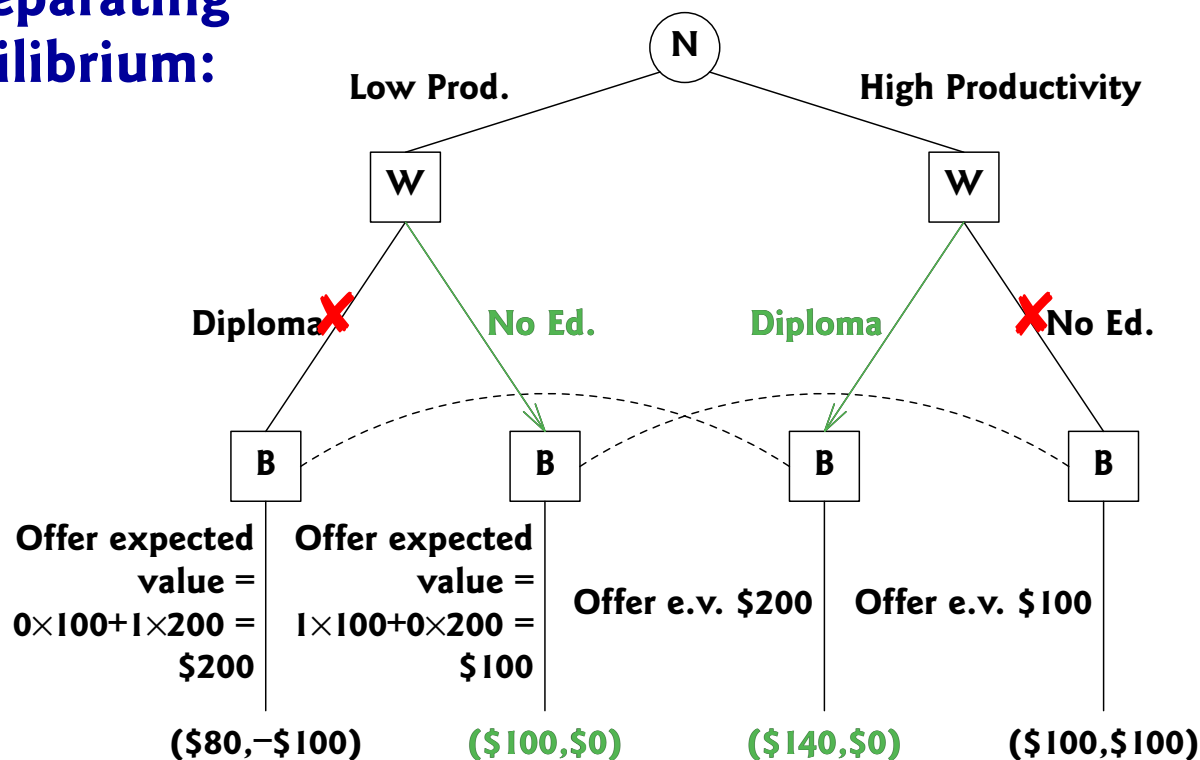
Wally and Betty begin with *beliefs* about how to interpret signals, and equilibrium means that, after each acts on his or her beliefs, neither sees anything to indicate the beliefs are mistaken.

(See Bayesian equilibrium: D&Sk, 2nd ed. pp. 284, 3rd ed. p. 341; B&F Ch. 13)

Betty's beliefs or expectations are crucial:

- **If Betty believes that all with the diploma are HP and all without are LP, then she will pay \$200 to graduates and \$100 to others.**
- **If Wally is HP and a graduate, then he earns net $\$200 - \$60 = \$140$. Without the diploma, HP Wally earns net \$100, \therefore education is profitable for HP Wally.**
- **If Wally is LP and has no diploma, then he earns net \$100. With the diploma LP Wally earns net $\$200 - \$120 = \$80$, \therefore education is unprofitable for LP Wally.**

A separating equilibrium:



Education as Signalling with Separating. (W,B)

	High	Low
Productivity	\$200	\$100
Cost of Diploma	\$60	\$120

Betty's expectations are fulfilled, and so are Wally's.

A separating Bayesian equilibrium in beliefs

Betty's expectations about education as a signal of productivity (which she learns of after hiring Wally) are confirmed.

Signalling in this example works: the market succeeds in *separating* LP from HP workers, despite the informational asymmetries.

For education to serve as a signal in this example, sufficient that it be:

- hard (costly) enough to obtain to deter LP Wally,**
- but not so hard (costly) to deter HP Wally.**

How is the credential set?

- By history or custom?**
- A social convention about the level of signalling sufficient for credibility.**
- Is an M.B.A. a credible signal in Australia in 2009? Elsewhen? Elsewhere?**

Signalling need not work: ➡ pooling, not separating.

A change in Betty's beliefs can change the equilibrium considerably:

- **Suppose Betty believes instead that although a diploma implies HP, without a diploma Wally could be HP or LP. She can't distinguish the two.**
 - **This can be self-confirming:
suppose there are 40% LP and 60% HP,
and Betty knows these proportions.**
 - **Betty's expected worth of Wally is $0.6 \times \$200 + 0.4 \times \$100 = \$160$, which is the wage Betty offers Wally without a diploma.**
 - **Wally with a diploma (👉 HP) is paid \$200.**
- Q: Will Wally obtain a diploma?
What is the new equilibrium?**

Will Wally obtain a diploma?

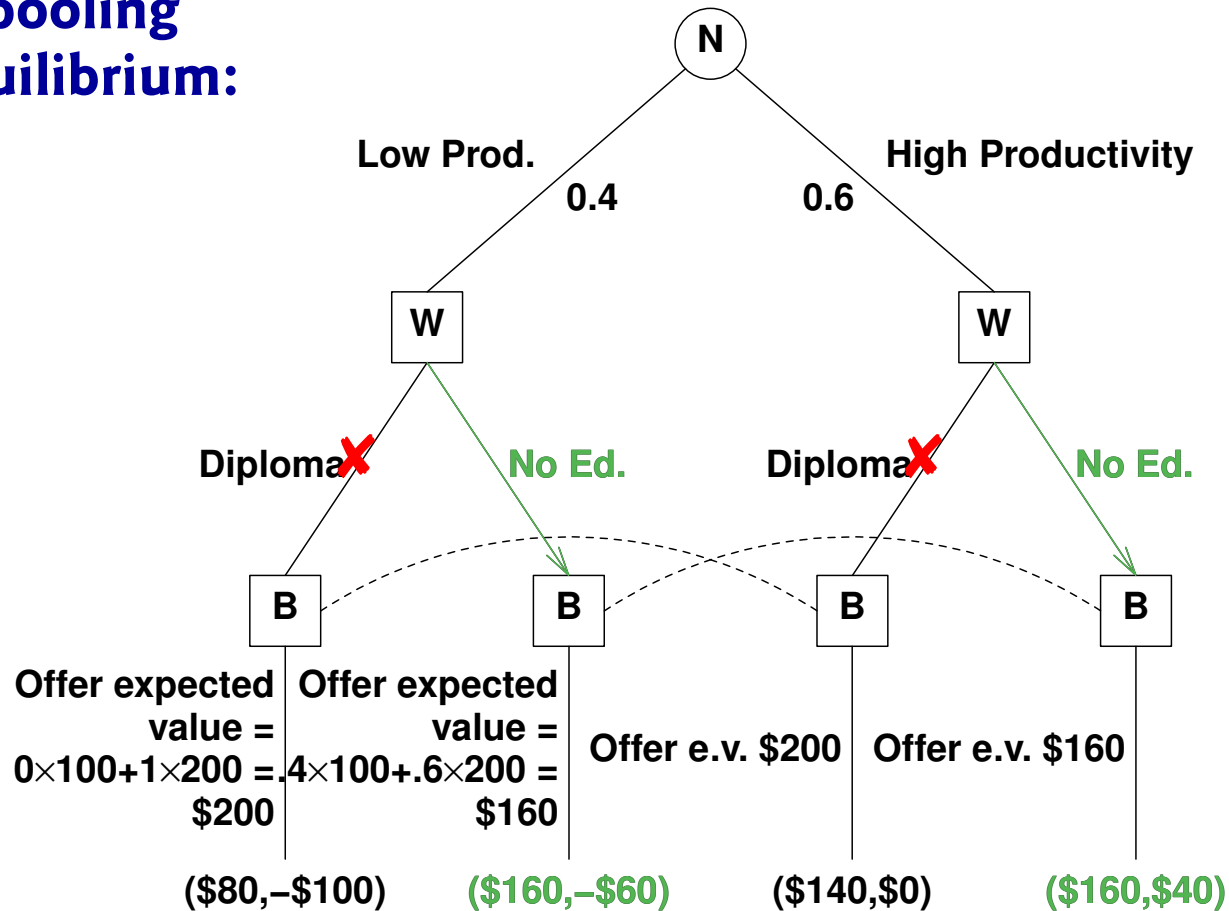
- **To HP Wally, the value of education is wage minus education costs: $\$200 - \$60 = \$140$, i.e. less than the $\$160$ Wally could earn without a diploma, \therefore education doesn't pay, even for HP Wally.**
- **To LP Wally, the diploma payoff is $\$200 - \$120 = \$80$, but no diploma \rightarrow $\$160$, \therefore no diploma for him, either.**
- **None is educated, and Betty's expectations are confirmed: 40% of the uneducated workers will be LP.**

\rightarrow *A pooling Bayesian equilibrium in beliefs.*

Equilibrium without signalling, even though a signal (education) is available to workers. Signalling cannot be guaranteed to work.

Again, Betty's expectations are crucial.

A pooling equilibrium:



Education as Signalling, with Pooling. (W,B)

	High	Low
Productivity	\$200	\$100
Cost of Diploma	\$60	\$120

(Bayesian Equilibrium in beliefs)

“Wasteful” Expenditures as Signals

Generally: expenditures — such as education — even if yield no direct benefit in themselves, can serve as communication devices, signals. Any observable expenditures that are cheaper for “good” signallers than for “bad” signallers might work.

“Try it, you’ll like it.”

How can you credibly communicate the value of your product (brake linings) to potential customers (car manufacturers), when you’re sure that they’ll be satisfied?

Obviously extravagant expenditures may signal success (wining & dining, lavish brochures, high-rent address, etc), if the potential buyer knows that you are relying on continued sales to cover these apparently unproductive costs: if your product were of low quality, you couldn’t cover your promotional expenditures. Or could you?

How costly should signals be?

Signals must be more costly (net of future earnings) for low-quality producers than for high-quality producers.

Wasteful expenditures don't necessarily work as signals: opportunities for signalling don't ensure that signalling actually occurs in the market.

(See Betty's beliefs above.)

Signalling is pervasive.

“When you drive around in a [\$900,000] Rolls Royce and seem to be spending all this money, everyone starts to prick their ears up about what’s going on,” says Jim Cousins, the chairman of the business lobby group, The Committee for Geelong. “All the way through I thought maybe he [Graeme Hay, former founder of the failed Ponzi scheme, Chartwell Enterprises, had] won one of those \$40 million Tattslotto draws.”

Chartwell quoted some returns up to 30% pa, and lost up to \$70 million of more than 100 of their retail investors.

– *AFR*, 5 May, 2008, p. 61, “Rolling in everyone else’s cash”.

More signalling ...

By giving a personal guarantee against his private assets, Alan tried to credibly communicate (to signal) that he believed the project wouldn't fail, in order to induce the Bank to lend him more. The bank (or the venture capitalist) might still want to check Alan's judgement, but not – Alan hopes – his sincerity.

e.g. Don't eat at a restaurant in Japan with poor-quality plastic models of its meals on display.

Nothing succeeds like the appearance of success.

– Christopher Lasch

5. The Market for “Lemons”

– see Reading 7 (The lemon dilemma).

Previously, there was uncertainty in Burt the buyer’s *valuation* of the car, unobservable by seller Sally.

Now, there is *uncertain quality* of the car, unobservable by Burt the buyer.

What is the effect on bargaining between Sally the seller and Burt the buyer?

- Market for used cars.
- Two qualities: high quality and “lemons”.
- Sally knows the quality,
- but Burt doesn’t before buying, although Burt does know the proportion of “lemons.”

George Akerlof shared the 2001 Nobel for his work on markets with asymmetric information; he coined the “lemons” tag.

Adverse selection

- **The risk of buying a “lemon” may deter buyers, unless the price is low enough.**
- **And the proportion of “lemons” offered for sale may exceed the proportion in the population if the owners of good cars are deterred from offering them for sale since they command no premium over “lemons” because buyers cannot distinguish the two qualities.**
- **Since a good car is worth more to its owner than a “lemon,”
then the sale price may be less than the value of *not* selling the car for the owners of good cars.**
- **No good cars will be offered for sale:
only “lemons” will be offered;
the price will slump.**
- **This is an example of *adverse selection*.**

Gresham's Law rules, OK?

For the second-hand car market to exist, the price of cars must be:

- ***low enough* for buyers to accept the risk of a “lemon.”**
- **and *high enough* to induce owners of good cars to sell.**

- **Inconsistent?**

If the proportion of “lemons” is too high, then the price will be too low for the owners of good cars to sell, and the market will die, with efficiency losses (potentially gainful trades exist, but cannot occur).

- **A Gresham's law of cars: the “lemons” drive out the good.**

Originally: “Bad money drives out good.” How?

Example: Second-Hand Car

- **60% of a model “lemons,” as Burt knows but can’t distinguish.**
- **To Burt the buyer,**
 - **a good car is worth (a maximum of) \$2000,**
 - **a “lemon” (a maximum of) \$1000;**

To Sally the seller, (a minimum of) \$1500 and \$500, respectively.

- **Sally knows the quality of the car she’s selling (∴ asymmetric information).**

What's the price?

- **First, there can be only one price since Burt can't distinguish between "lemons" and good cars.**
- **Burt ignores Sally's claims of quality, "Well, she would say that, wouldn't she", as Mandy Rice Davies might have said. (A babbling equilibrium?)**
- **For risk-neutral Burt, pay up to $0.6 \times \$1000 + 0.4 \times \$2000 = \$1400$, the expected value.**
- **If the market operates and potential Burts exceed the numbers of cars for sale, then this is the market price.**

A separating equilibrium

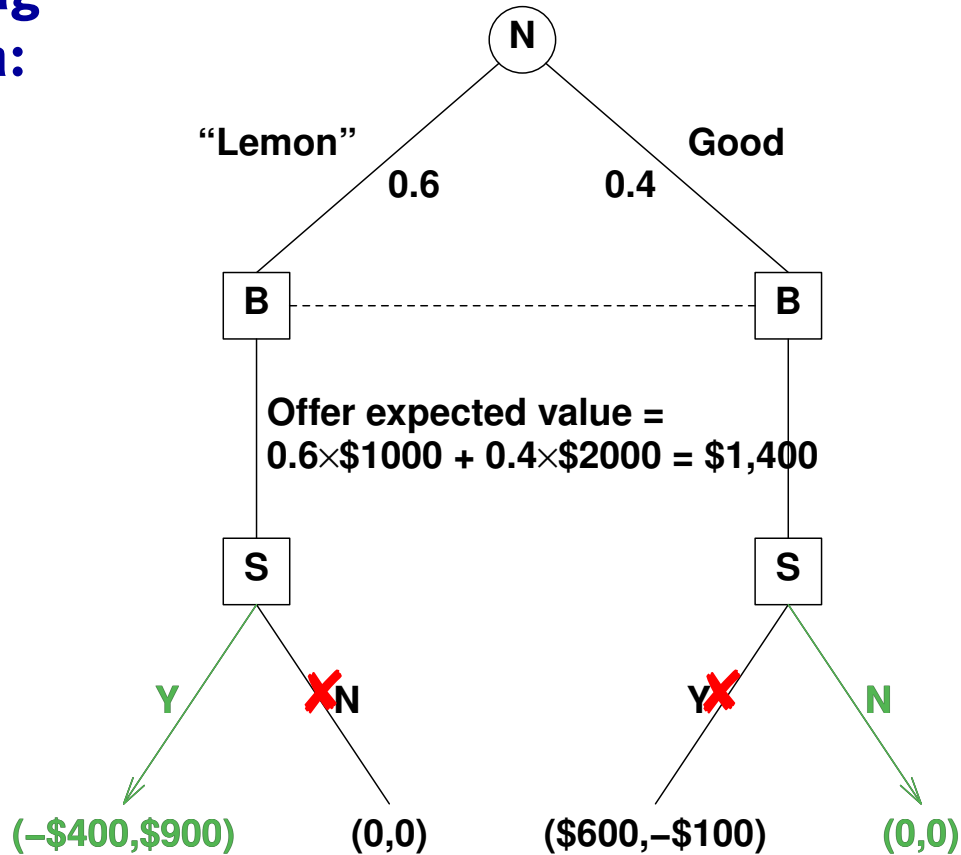
Will the market operate if Burt offers \$1400?

Will Sallys be willing to sell at \$1400?

- **Certainly the owners of “lemons” will,**
- **but what about the owners of good cars?**
They won’t, since they value good cars at \$1500, and will withhold them.
- **But then the proportion of good cars for sale is too low, in consequence.**
- **The market will not operate, a further inefficiency as a consequence of the privacy of information.**
- **Potential gains to trade exist (\$2000 to Burt, \$1500 to Sally), but since Burt can’t tell good from “lemon,” then no trade.**

∴ *A separating equilibrium.*

A separating equilibrium:



The Market for Lemons with Separating. (B,S)

	"Lemon"	Good
Burt the buyer will pay up to	\$1,000	\$2,000
Sally the seller will accept down to	\$500	\$1,500

***Insurance markets* and private information about health and longevity.**

Will insurance companies expect a disproportionate number of unhealthy people to be attracted? Consequences? (“Moral hazard.”)

A pooling equilibrium

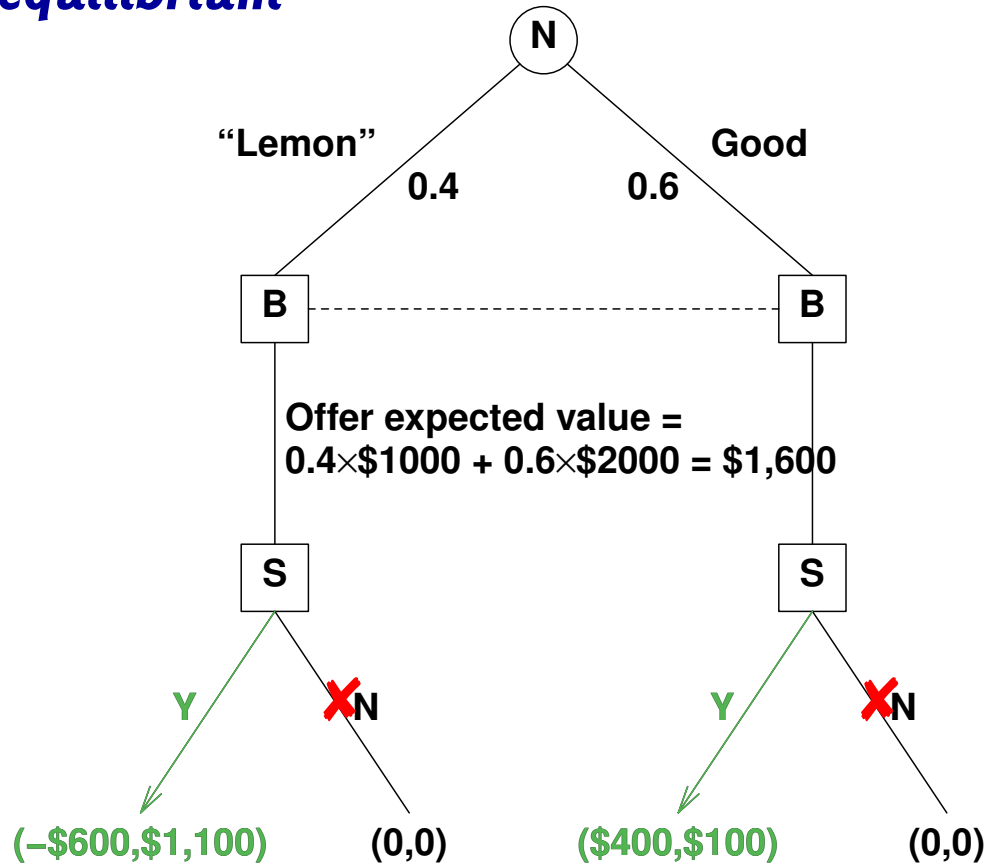
But: Private information is not always a problem ...

Private information not always a problem:

What if there are fewer “lemons:” 40% instead of 60%?

- **if the proportion of “lemons” is 40% and is common knowledge,**
 - **then Burt will pay up to $0.4 \times \$1000 + 0.6 \times \$2000 = \$1600$, the expected value,**
 - **a price at which Sally selling a good car gets a gain of $\$1600 - \$1500 = \$100$.**
 - **The market will exist, with a price between \$1500 and \$1600, despite the informational asymmetry.**
 - **Although some gain (buyers of good cars) and others lose (sellers of good cars) compared to fully informed trading.**
- ∴ A pooling equilibrium.**

A pooling equilibrium game tree.



The Market for Lemons with Pooling. (B,S)

	"Lemon"	Good
Burt the buyer will pay up to	\$1,000	\$2,000
Sally the seller will accept down to	\$500	\$1,500

Asymmetric Information & the Sub-Prime Crisis

“.. nothing stopped the banks selling lemon bonds. Like used cars that break down right after they are sold, the seller could reduce the quality of the product and cut costs without the buyer’s knowledge. As low-quality products sell at the same price as high-quality products, the latter disappear from the market.

In capital markets, the information asymmetry between buyers and sellers of securities is even more extreme, making it hugely tempting for banks to issue securities to increase their expected profits by reducing the repayment probability below what buyers expect.”

– Hans-Werner Sinn, “Lemon Banking and the Subprime Crisis,” April, 2008. (Reading 24.)

Summary

Negotiation strategies depend on what information is public and what private.

- ***Screening or Sorting.* Strategies to defend yourself against another's informational advantage, against adverse selection. (Sally's pricing schedule)**
- ***Signalling.* Strategies to exploit your own informational advantage (Wally's diploma & Betty)**

Signalling is *credible communication* of private information. Signalling must not only cost you to undertake it, but the other party must know that your cost is higher if you're misrepresenting yourself than if you're being truthful.

Possible inefficient breakdown

Bargaining under incomplete or asymmetrical information has a PD character: breakdown may occur with its attendant inefficiencies and dead-weight losses. Breakdown doesn't imply irrationality in these circumstances.

You may be able to induce the other party to reveal private information, thus overcoming your informational disadvantage:

- the opponent's costs of delay or your lack of information over opponent's limits may result in haggling;**
- the cost of delay may reveal your opponent's smallest acceptable share of the gains to trade, if you start by demanding a large share.**

Another way of reducing your informational handicap is to play one bidder off against another – using competition – to induce them to reveal at least part of what they know, see Bidding and Auction Design. (Lecture 18.)

Evidence of Signalling and Screening

- **Insurance companies**
- **Venture capitalists**
- **Quality of durable goods**
- **Borrowing**
- **Health insurance**
- **Others?**