

# The Leverage Cycle

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# Recent Historical Examples

- 1994 derivatives
- 1998 emerging markets and mortgages
- 2007-8 mortgage crash

# Leverage Cycle Papers

- Geanakoplos 1997 “Promises Promises”
- Geanakoplos 2003 “Liquidity, Default, and Crashes: Endogenous Contracts in General Equilibrium”
- Fostel-Geanakoplos 2008 “Leverage Cycles and the Anxious Economy”

# Collateral Levels = Margins = Leverage

- From Irving Fisher in 1890s and before it has been commonly supposed that the **interest rate** is the most important variable in the economy.
- But **collateral** levels are more important in times of crisis.
- Perhaps the **Fed** should pay more attention to collateral levels and pay less attention to interest rates. Is it trying now?

# Keeping Promises

- **Collateral** = Asset put up as guarantee of loan. Often a house.
- If can use \$100 house to borrow \$80, then **margin** is 20%, **LTV** is 80%, and **leverage** is 5.
- Cannot borrow without collateral. Collateral can become **scarce**.

# I. Equilibrium Leverage

Standard Economic Theory:

Equilibrium (supply = demand) determines interest rate.

In my theory:

Equilibrium determines Leverage as well. Surprising that one equation can determine two variables.

Not determined by an ad hoc rule of thumb (VAR or volatility)

## II. Heterogeneous Agents

### Natural Buyers

- Differ in risk tolerance.
  - Differ in ability to hedge.
  - Differ in sophistication and knowledge.
  - Might use assets for production.
  - Or just more optimistic.
- 
- Logically very similar, according to modern decision theory. More means more willing to pay.

# III. Right Price?

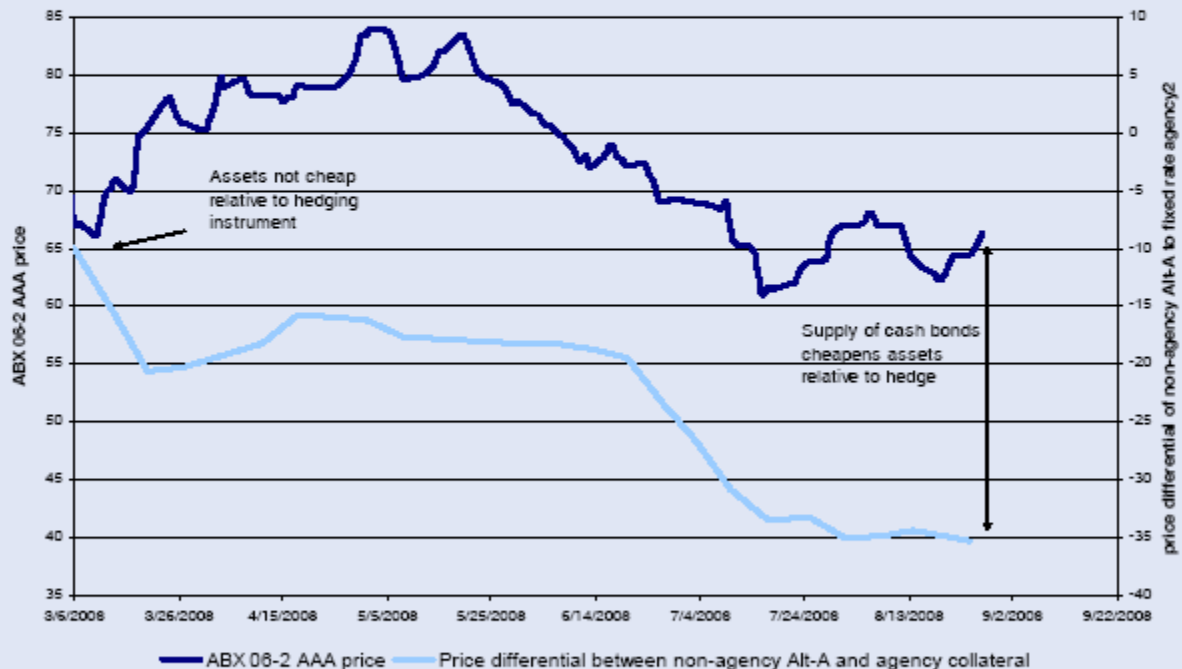
- No such thing. Depends on who has the money. If take it away from optimists and give it to pessimists, then price goes down.
- Optimists generally more savvy. So reality may be more likely to follow their predictions.
- Orthodox view is assets priced according to fundamental value.
- Market supposedly averages out opinions, gets it right.
- Market actually weights opinions by buying power.

IV More Leverage →  
Higher Asset Prices  
Low Leverage →  
Lower Asset Prices

- Leverage gives optimists more buying power.
- Relies on no short sales.

## Deviations in certain segments of the industry have created opportunities for long/short managers

- For example, the Alt-A AAA segment of the market has cheapened 25% since March 2008, while ABX 06-2 AAA index is little-changed<sup>1</sup>



<sup>1</sup> Source: Markit, Lehman Bros. Alt-A refers to a classification of mortgages where the risk profile falls between prime and subprime

<sup>2</sup> Price differential results from lower liquidity and perceived higher credit risk of non-agency collateral versus comparable agency collateral due to the implied government-backing of agency collateral. Agencies include, for example, Fannie Mae and Freddie Mac.

Note: The above chart is for illustrative purposes only. The examples presented should not be considered a recommendation to purchase or sell any particular security. The securities discussed are not representative of the Fund's holdings.

There is no assurance that Ellington will be able to identify or secure investment in securities substantially like those discussed.

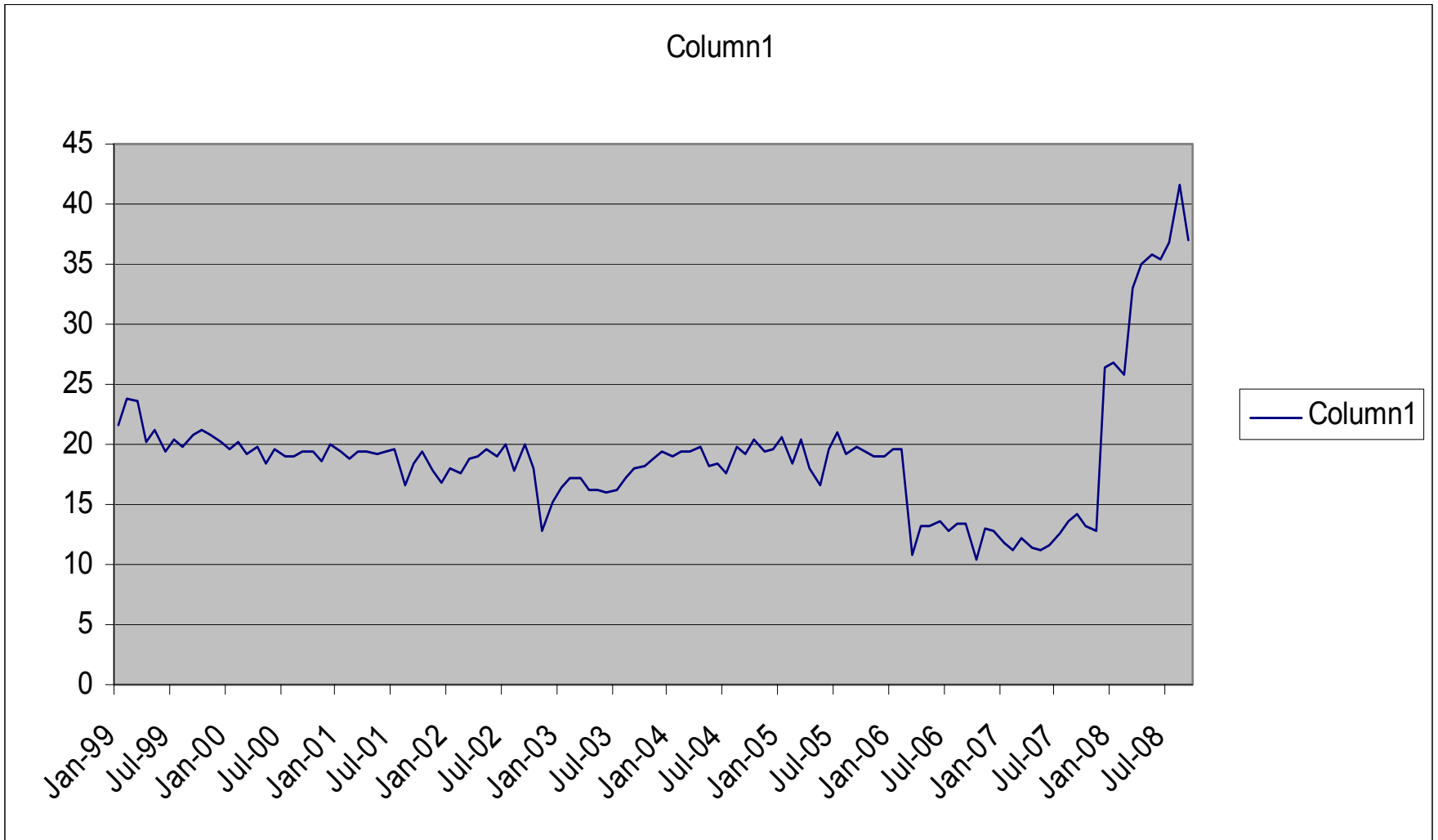
# Leverage and Housing

- Leverage at the beginning is clearly helpful. Loaning money against houses permits people to buy houses who could never otherwise afford a house.
- But after awhile it also drives the prices so high that it stops being good for them.
- House boom not all irrational exuberance or wild extrapolation. It was also more leverage.

# V. Leverage Cycle

- Too much equilibrium leverage in normal times
- Too little leverage in crisis
- Dynamic that is recurring

# All CMO haircuts at Ellington



# VI. Scary news

- Why does leverage change?
- Bad news, **scary news**
  - lowers expected values
  - increases expected volatility
  - Increases disagreement
- Normal times not so much volatility and disagreement.
- All competitive. Pressure on money managers to keep returns high in normal times.

# De-Leveraging Now

- When disagreement over mortgage defaults ranges from  $\frac{1}{4}\%$  to  $\frac{1}{2}\%$ , easy to borrow.
- When disagreement over 30% vs 70% hard to borrow.
- Lenders are pessimists. Otherwise they would be buying.

# De-Leveraging Now

- AAA can borrow, BBB cannot borrow. Many downgrades coming or here. BBB means not just worse expectation, but more risk and disagreement.
- End of securitization. Senior tranche was just way to leverage lower tranche.
- Investment banks afraid to put stuff on balance sheet, because shareholders pessimistic.

# VII. Rational Agents

- Leverage cycle occurs even if everyone is rational. No need to assume people naively extrapolate rising trends to rising expectations. No assumption of irrational exuberance. No ignoring of warning signs.
- Even if they remember this cycle, we will have another, unless the Fed stops it.

# VIII. Fed should manage leverage cycle

- Fed should monitor collateral levels.
- When they get too loose, fed should tighten them.
- When they get too tight, Fed should intervene to lighten them. Like now.
- Whole new mandate for Fed.

# IX. New asset pricing

- Liquidity Wedge
  - How much extra interest would somebody be willing to pay if he believed he would deliver for sure but did not have to put up collateral.
- Collateral Value
  - Price = Payoff Value + Collateral Value
- Death of Efficient Markets

# X. More Phases of Financial Turmoil

- **Normal Economy**
  - Leverage high, liquidity wedge low
- **Exuberant Economy**
  - Leverage extremely high, liquidity wedge almost zero
- **Anxious Economy**
  - Leverage curtailed, liquidity wedge high
  - Scary news but no defaults yet
  - Public anxiously selling to natural buyers
  - Catching a Falling Knife?
- **Crisis Economy**
  - Leverage plummets, liquidity wedge soars
  - Leveraged natural buyers forced to liquidate or sell-off to public



# XI. Contagion

- In anxious stage scary news about one asset and more disagreement about it creates buying opportunity for optimists.
- They have less money to spend on other things, so those go down in value.
- Relies on small class of natural buyers.

## XII. Flight to Collateral

- Different from flight to quality.
- Liquidity wedge goes up.
- Payoff values go down.
- Collateral value goes up.
- Assets that are good collateral gain some collateral value, partially compensating for payoff value decline.
- When in trouble sell unleveraged assets.

# XIII. Natural Buyers and Endogenous Margins Theory of Crashes

The thesis is that a liquidity crisis begins when bad news about assets lowers their prices, which then redistributes wealth away from their natural buyers. But the crisis only reaches its climax when the margin requirements are tightened.

- i) Asset goes down in price when probability of bad outcome objectively rises.
- ii) This causes big drop in income of **natural buyers** who were leveraged.
- iii) This leads to further loss in its value.
- iv) Then **margin** requirements tightened if volatility increases, for example because time horizon of potential default shortens.
- v) This causes huge loss in its value via forced sales.
- vi) There may be spillovers if sales of other assets forced.
- vii) Investors who remain have great opportunity

# XIV. Irrationality

- Not needed for leverage cycle.
- But makes cycle worse.
- People extrapolate big recent losses and fear more big moves, won't lend.
- Prices rising for a long time lenders not afraid of default.

# XV. Layered leverage cycles

- Security subject to leverage cycle price effects.
- Payoffs of security also suffer from leverage cycle.
- Mortgage bonds suffer from leverage cycle, but homeowner payments do as well.

Leverage cycle explains why it may be important to use margins as policy instruments during crises

# Geanakoplos-Kubler 2006

## Pareto Improving Margins

- Market forces do *not* necessarily choose *socially optimal margins*. **Regulating Margins can make everybody better off.**
- **Regulate tighter margins in normal times, looser in crisis times.**
- Fed intervention does not cause **moral hazard**. Knowing that because of Fed it is possible to survive a crisis if you are not too far over the edge leads rational firms to be more prudent.

Regulating margins  
also important from a global perspective  
to avoid spillovers to different markets,  
and not just during a crisis

# How should Fed intervene?

- After example

# **Shakespeare the Economist:**

## **Interest and Collateral in the Merchant of Venice.**



SHAKESPEARE

# The Merchant of Venice

# Play Begins

A. In sooth I know not why I am so sad:....

S. Your mind is tossing on the ocean;  
There where your argosies with portly  
sail...

A. Believe me no— I thank my fortune for it—  
My ventures are not in one bottom trusted,  
Nor to one place; nor is my whole estate  
Upon the fortune of the present year:  
Therefore my merchandise make me not  
sad.

S. Why then you are in love.

A. Fie, fie!

# Economics before Love

- It's about economics, not love.
- Shakespeare understands diversification.

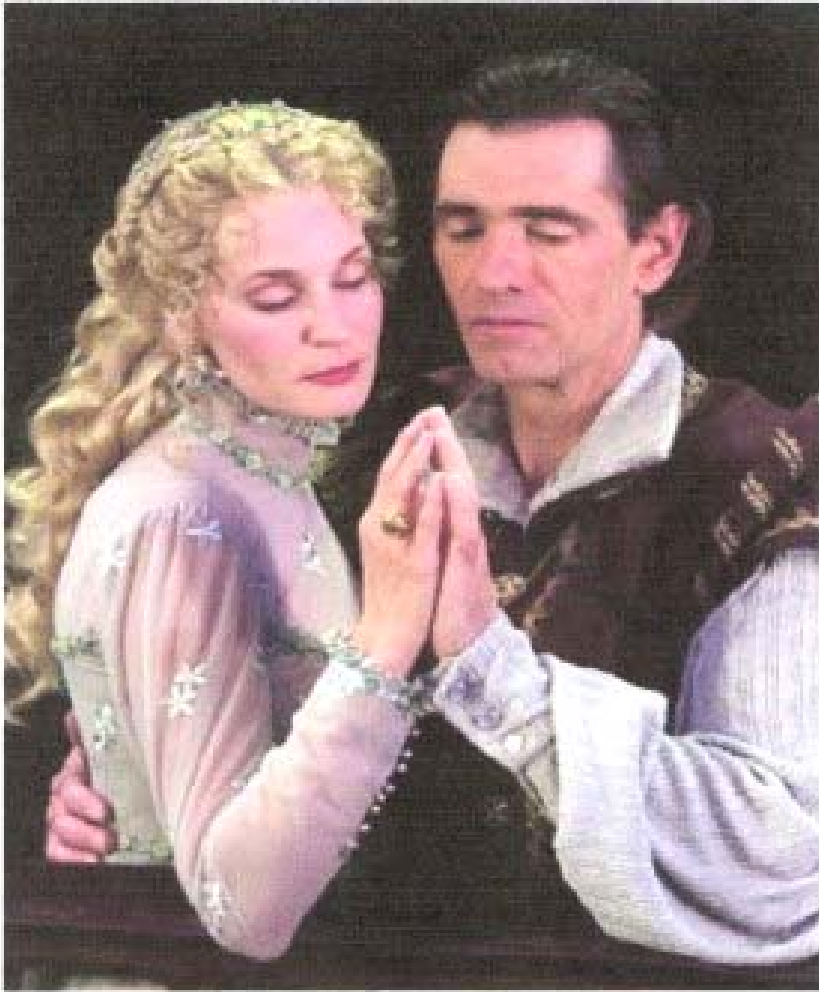
# Shakespeare knows his economics

Shylock's daughter Jessica runs off with a Christian and converts, robbing Shylock of his ducats and his wife's ring.

Lancelot: "This making of Christians will raise the price of hogs."

Supply and demand affect price

# The Merchant of Venice



Portia

Bassanio

Second Contract

**P:**”You must take your chance,  
And either not attempt to choose at all,  
Or swear, before you choose, if you choose wrong,  
Never to speak to lady afterward  
In way of marriage.”

Contract

Risk  
Gamble

Three casquets:

Gold: “Who chooseth me shall gain what many men desire.”

Silver: “Who chooseth me shall get as much as he deserves.”

Lead: Who chooseth me must give and hazard all he hath.”

Who chooses his meaning, chooses you

**Morocco:**“If Hercules and Lichas play at dice  
Which is the better man, the greater throw  
May turn by fortune from the weaker hand”

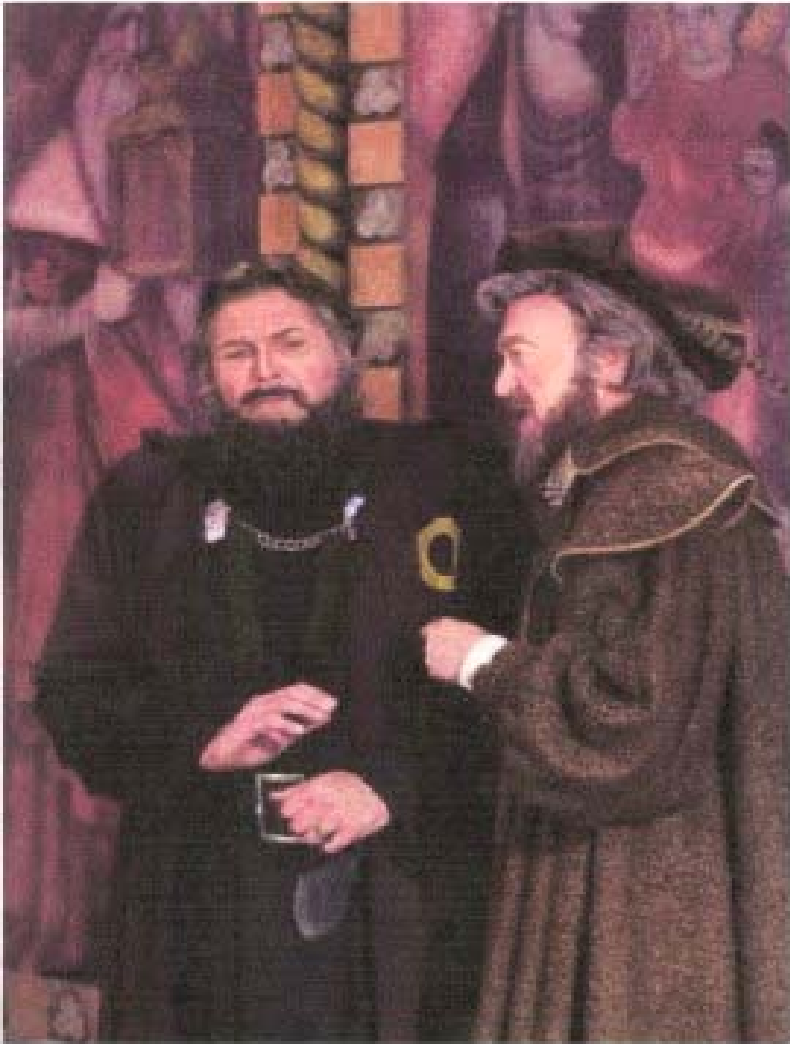
**Morocco:**“Men that hazard all  
Do it in hope of fair advantages”

**Arragon:**“Who chooseth me shall give and hazard all he hath?  
You shall look fairer, ere I give or hazard.”

**Bassanio:** “but thou, thou meagre lead,  
Which rather threaten’st than dost promise aught,  
Thy plainness moves me more than eloquence,  
And here choose I -joy be the consequence!”



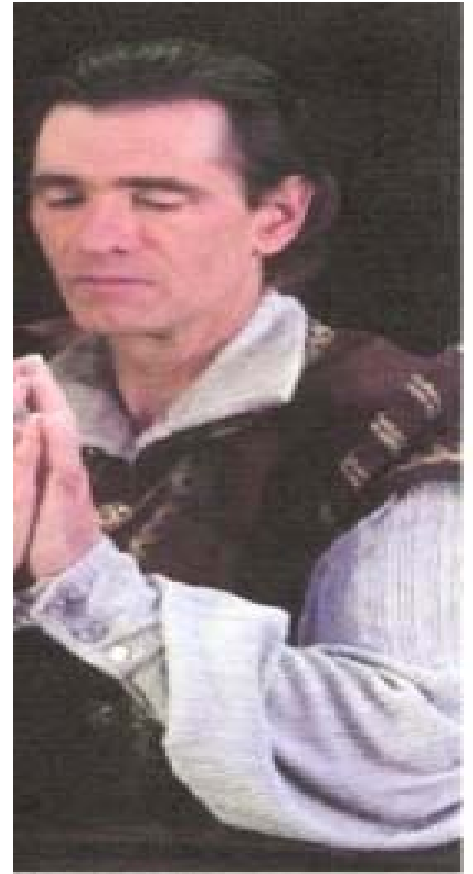
## The Merchant of Venice



Shylock

Bassanio

Antonio



**First Contract**

- Bassanio needs to borrow 3000 ducats for 3 months in order to woo beautiful (and rich) Portia. Short term loan.
- Antonio guarantees the loan.
- Shylock lends the money (obtaining part of it from Tubal, which shows it is a vast sum).

# Negotiation

- Over interest rate.
- And over collateral.
- Equilibrium must determine both.

# Impatience Theory of Interest

- Antonio argues interest is theft, and unchristian.
- Shylock gives Irving Fisher's Impatience theory of interest.

**A:** “Shylock, albeit I neither lend nor borrow  
By taking nor by giving of excess,  
Yet to supply the ripe wants of my friend  
I’ll break a custom.”



**S:** “In the Rialto you have rated me  
About my moneys and my usances:  
Still have I borne it with a patient shrug,  
For suff’rance is the badge of all our tribe.  
....



# Interest vs Collateral?

- Which did Shakespeare think more important?
- What interest did Shylock charge?

Shylock charges interest  $r = 0$ .



Interest  
Rate



Contract

**S:**“I would be your friends with you and have your love  
Forget the shames you have stained me with,  
Supply your present wants, and take no do it  
Of usance for my moneys,…”

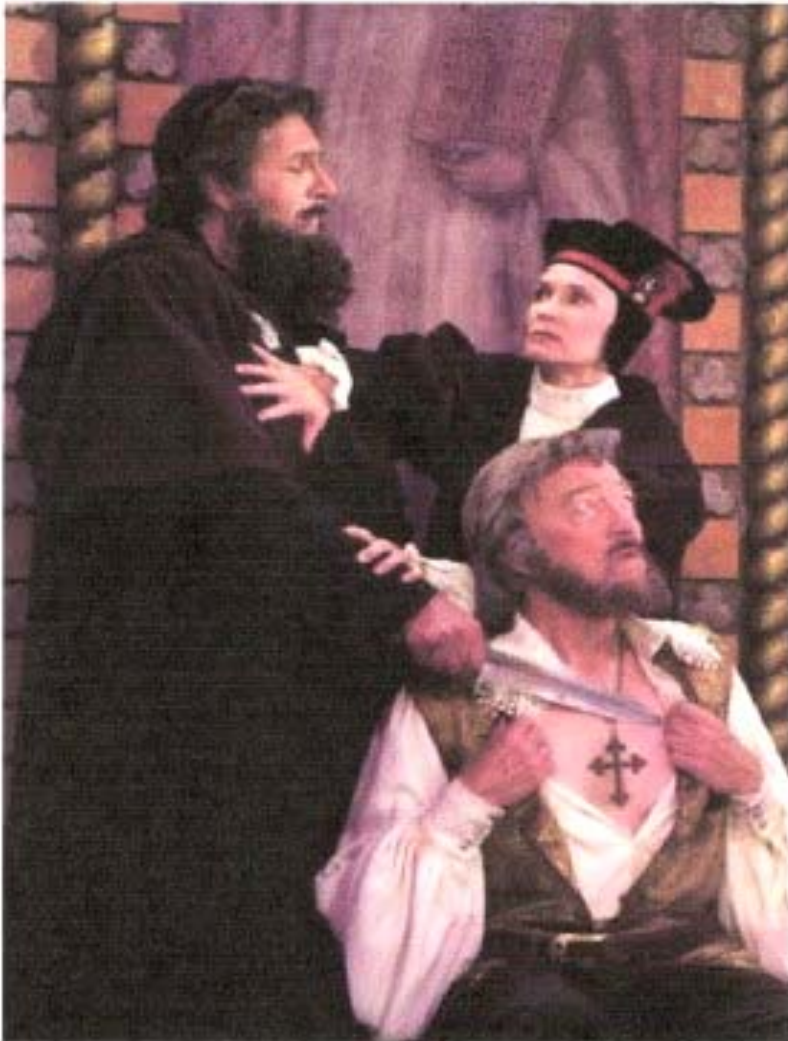
S: Go with me to a notary, seal me there  
Your single bond, and, in a merry sport,  
If you repay me not on such a day,  
In such a place, such sum or sums as are  
Expressed in the condition, let the forfeit  
Be nominated for an equal pound  
Of your fair flesh, to be cut off and taken  
In what part of your body pleaseth me.”



# Antonio's Calamity

- “Sweet Bassanio, my ships have all miscarried, my creditors grow cruel, my estate is very low, my bond to the Jew is forfeit.”
- Should Antonio be forced to give up the collateral?
- Shylock says yes.

## The Merchant of Venice



Shylock

Portia

Antonio

**The Enforcement**

# Judgment: Mercy?

- Portia enters, disguised as a young judge from Rome. She asks

“Who is the merchant here, and which is the Jew.”

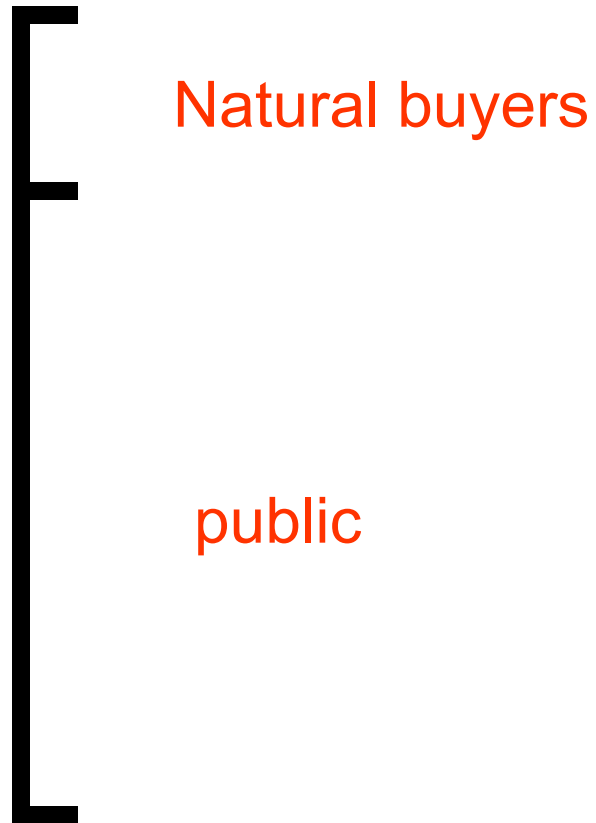
“The quality of mercy is not strained,  
It droppeth as the gentle rain from heaven  
Upon the place beneath. It is twice blessed:  
It blesseth him that gives, and him that  
takes.”

# Judgment: Wrong Collateral level!

- **P:** “Wait a moment. There is something else. This bond
- Does not give you one drop of blood. The words
- Expressly are “a pound of flesh”. So take your
- Bond. Take your pound of flesh. But if, in cutting it, you shed
- One drop of Christian blood, your lands and goods, under the
- Laws of Venice, will be confiscated to the sate of Venice.”

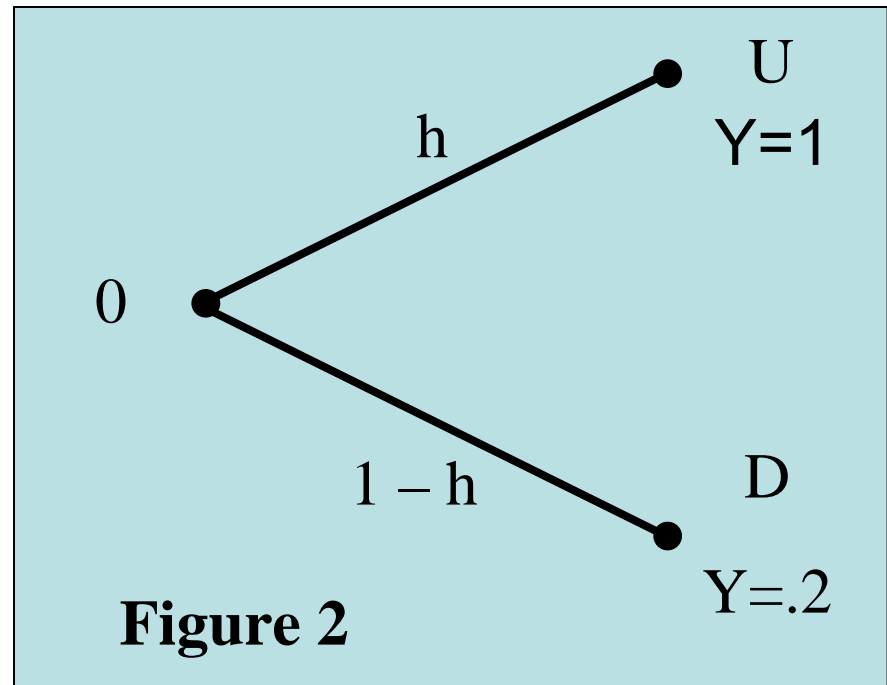
# III. Concrete Example of Crash

# Natural Buyers-Margins Theory of Crashes



# Endogenous Collateral with Heterogeneous Beliefs: A Simple Example

Let each agent  $h \in H \subset [0,1]$  assign probability  $h$  to **U** and probability  $1 - h$  to **D**. Agents with  $h$  near 1 are optimists, agents with  $h$  near 0 are pessimists.



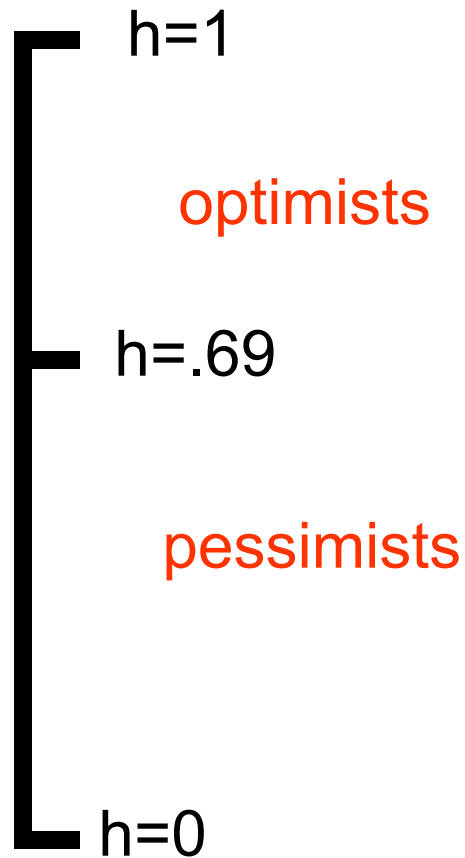
Suppose that 1 unit of  $Y$  gives \$1 unit in state **U** and .2 units in **D**.

Fundamental Value? Marginal Buyer.

# Fundamental value?

- If **cannot borrow**, price is **.68**. Marginal buyer is .6. Top 40% can pay .40 for .60 units.
- If can borrow 1 at zero interest, price is 1.
- If can borrow .2 at zero interest, then price is .75. Marginal buyer is .69.
  - Who would do lending? Bottom 69%.
  - Interest rate = 0 is correct. Lender competition forces interest that low, since they have plenty more to lend.

Buyers and Sellers if  
Margin =  $.55/.75 = 73\%$ ;  
Leverage =  $.75/.55 = 1.36$ .



# Margin

- Price depends on how much optimists can borrow.
- How can supply = demand determine both price (interest rate) and margin (collateral requirement)?
- It does. But not optimally for social welfare.
- In example, can borrow  $.2 = \max$  with no default.

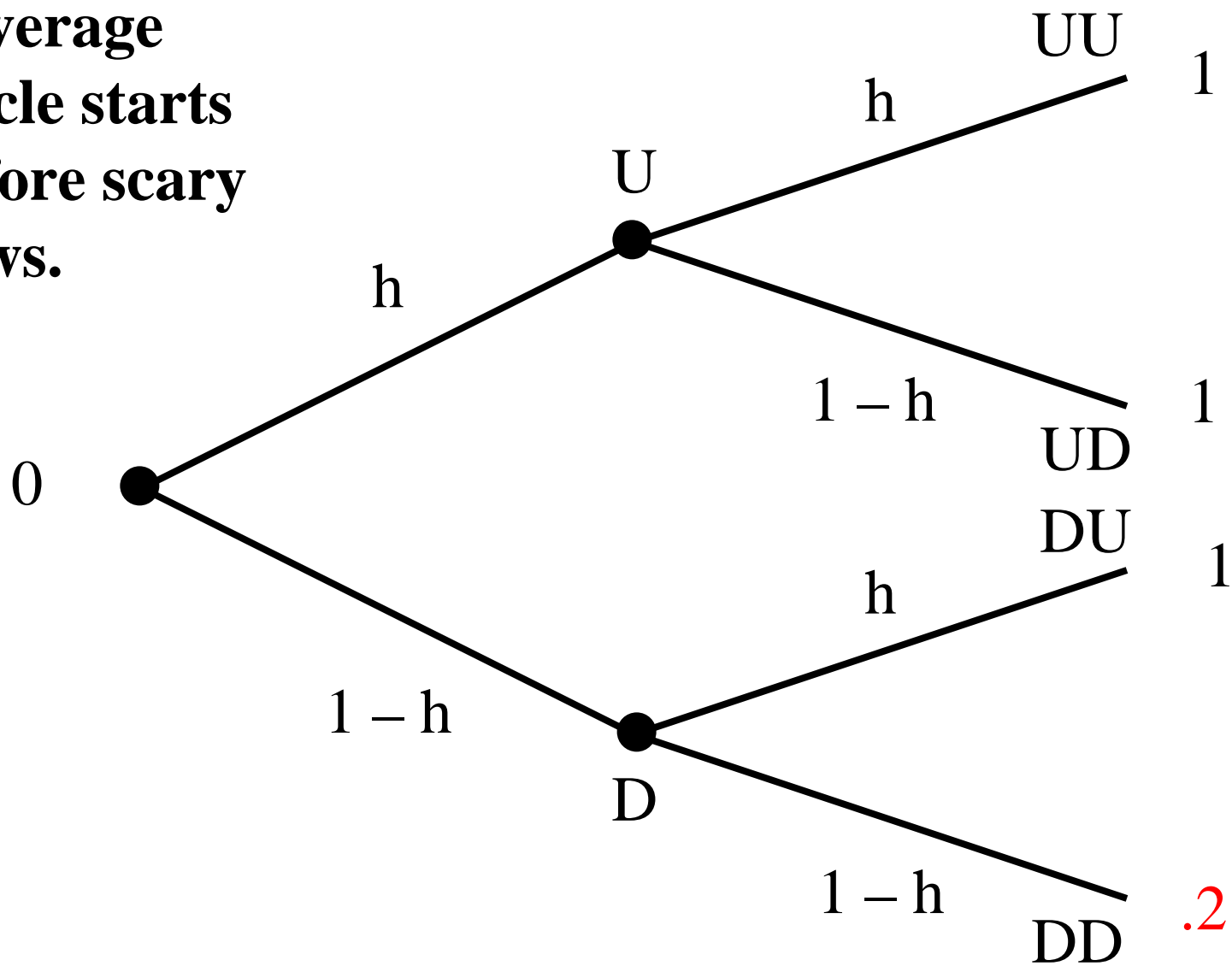
# Why not borrow more?

- If borrow .27, pay 12% interest = .3 at U, .2 at D.
- If borrow .34, pay 19% = 4 at U, .2 at D.
- Nobody would want to!

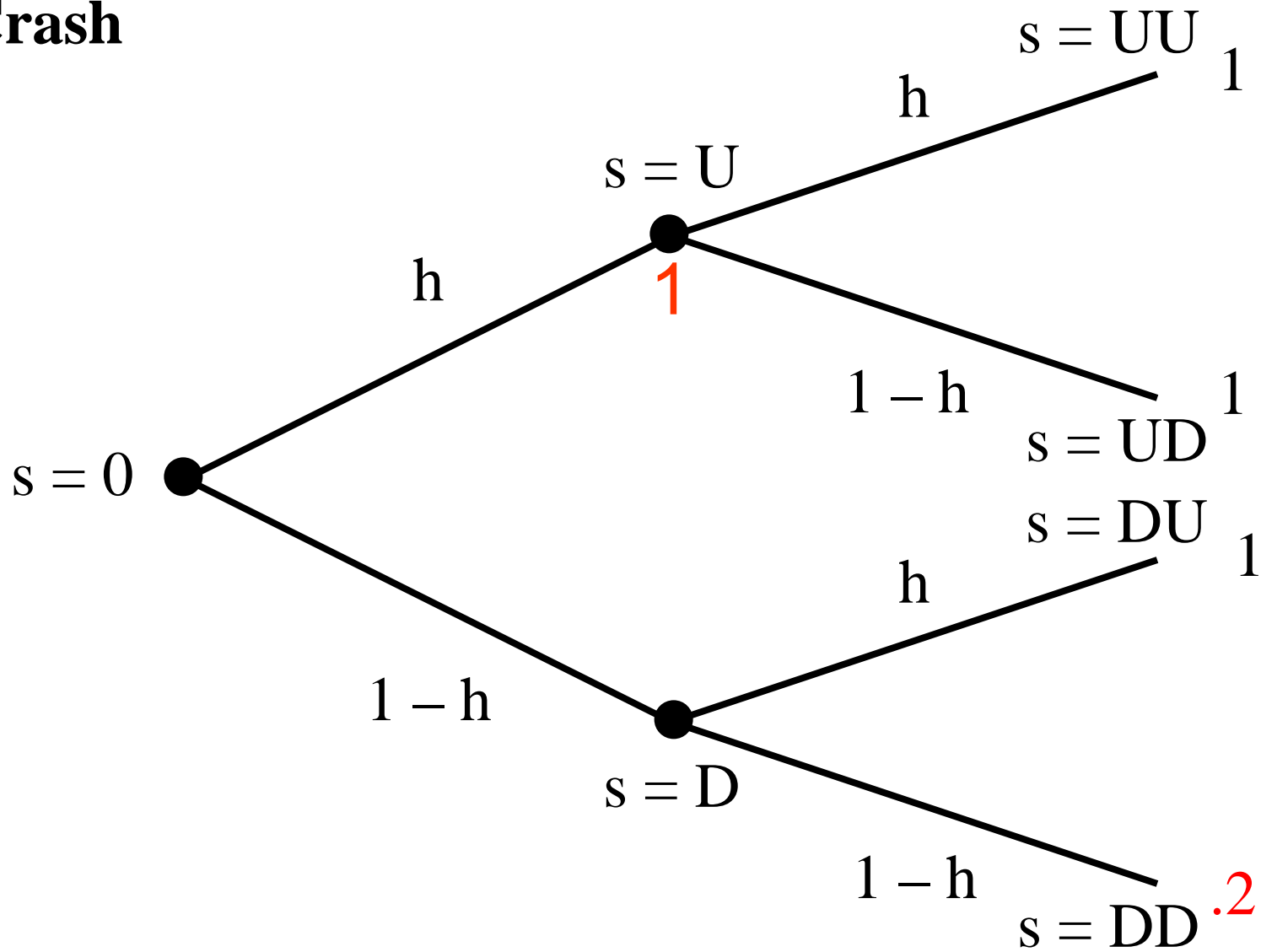
# Situation bad

- Terrible disagreement
- But nobody bankrupt
- Very bad if get to .2 = fundamentals collapse.
- But far from there. Mr. 69 thinks only 31% chance. Average buyer thinks 15% chance.
- Problem is when bankruptcies etc before fundamentals collapse.

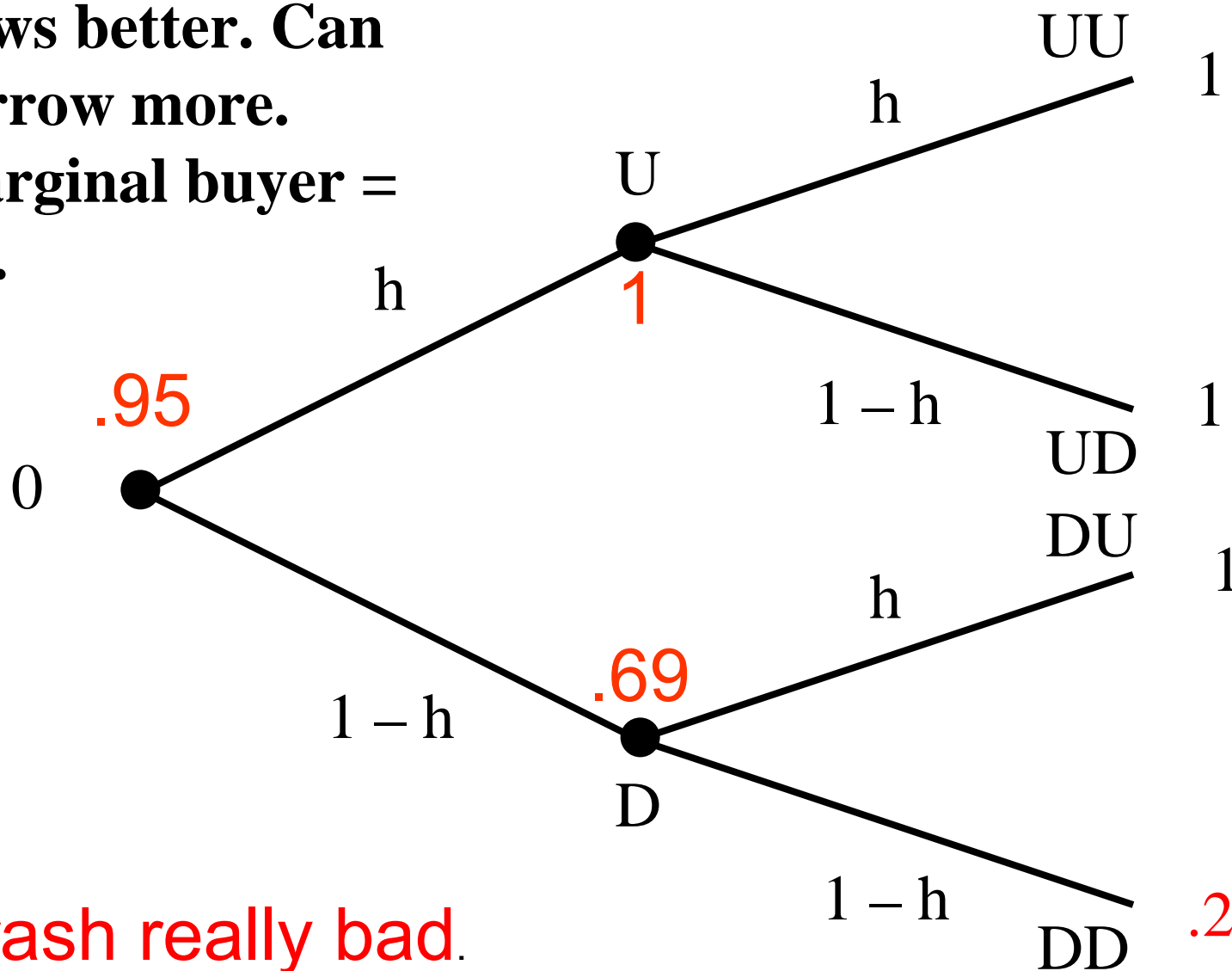
**Leverage  
Cycle starts  
before scary  
news.**



# Crash

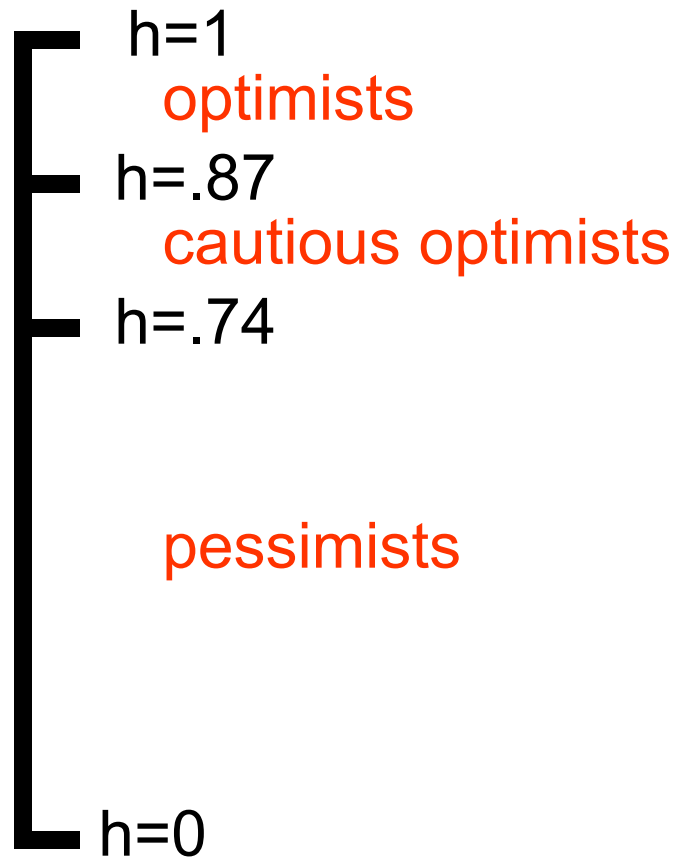


News better. Can borrow more.  
 Marginal buyer = .87.



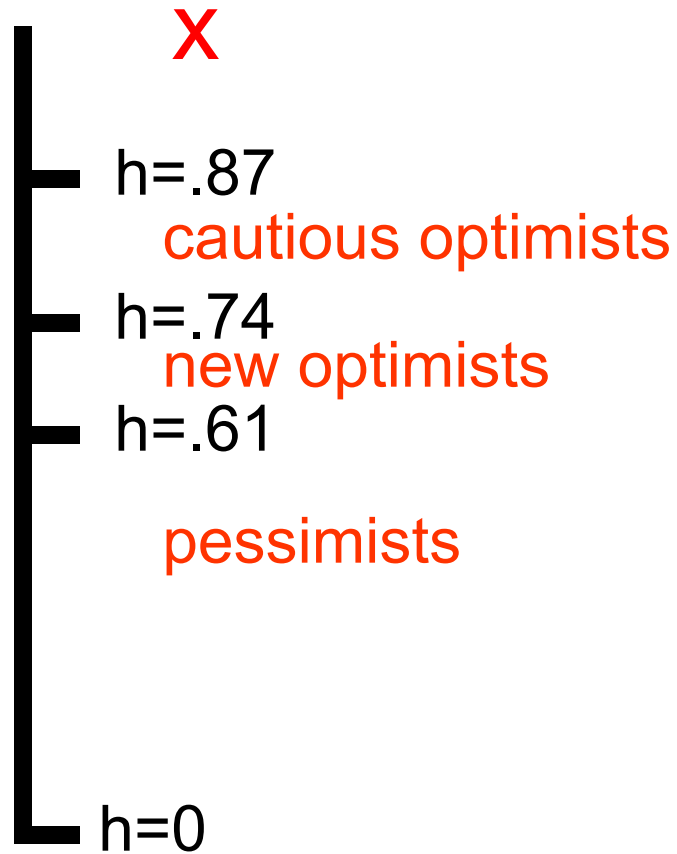
Crash really bad.  
 13% bankruptcies. Price = .69 < .75.

# Rational Agents.



# Why crash at D?

- **Objective bad news.**  $(1 - h)^2$  becomes  $(1 - h)$
- **Top tier of optimists disappear.**
- **Margins change.** Now can borrow only .2 instead of .69. Leverage went from  $.95/.26 = 3.6$  to  $.69/.49 = 1.4$ .
- Crash would not occur if any of three missing.



# Regulation?

- Economy better off if margins regulated to be tighter in normal times.
- Also better if prevented from tightening so much in crisis.
- What should bailout be?
- Remember cause of crash:
  - Bad news
  - Loss of equity capital by optimists
  - Margins tighter.

# Goals of plan unclear.

- How many people does Paulson want to save?
- What price do they want.
  - 75 get after putting back equity capital
  - 85 after also putting back margins
  - Or more. Enrich worst investors!
- How fast should relief come.

# Problem of proposal

- Buy what?
- At what price?

# Rescue based on Logic of Leverage Cycle

- Lending facility.
- Inject capital by investing with optimistic managers at reduced fees.
- Add subsidy to targeted sellers.
- Case by case bailout with equity seizures.

End