The Leverage Cycle

John Geanakoplos

Geanakoplos 2003
"Liquidity, Default, and Crashes:
Endogenous Contracts in General Equilibrium"

Follows model in

Geanakoplos 1997
"Promises Promises"

Fostel-Geanakoplos 2007 (unpublished)
"Emerging Markets in an Anxious Global Economy:
Contagion, Flight to Liquidity, and Issuance Rationing"

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?

Standard Economic Theory:

Equilibrium (supply = demand) determines interest rate.

In my theory:

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

Key concept: Leverage Cycle

- Too much equilibrium leverage in normal times
- Bad news
  - lowers expected values
  - increases expected volatility
- Too little leverage in crisis

Sub-prime Homeowner

- The problem today is not too high sub-prime interest rates, but too big down-payment.

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 (slightly) in value when probability of bad outcome objectively rises (slightly).

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.

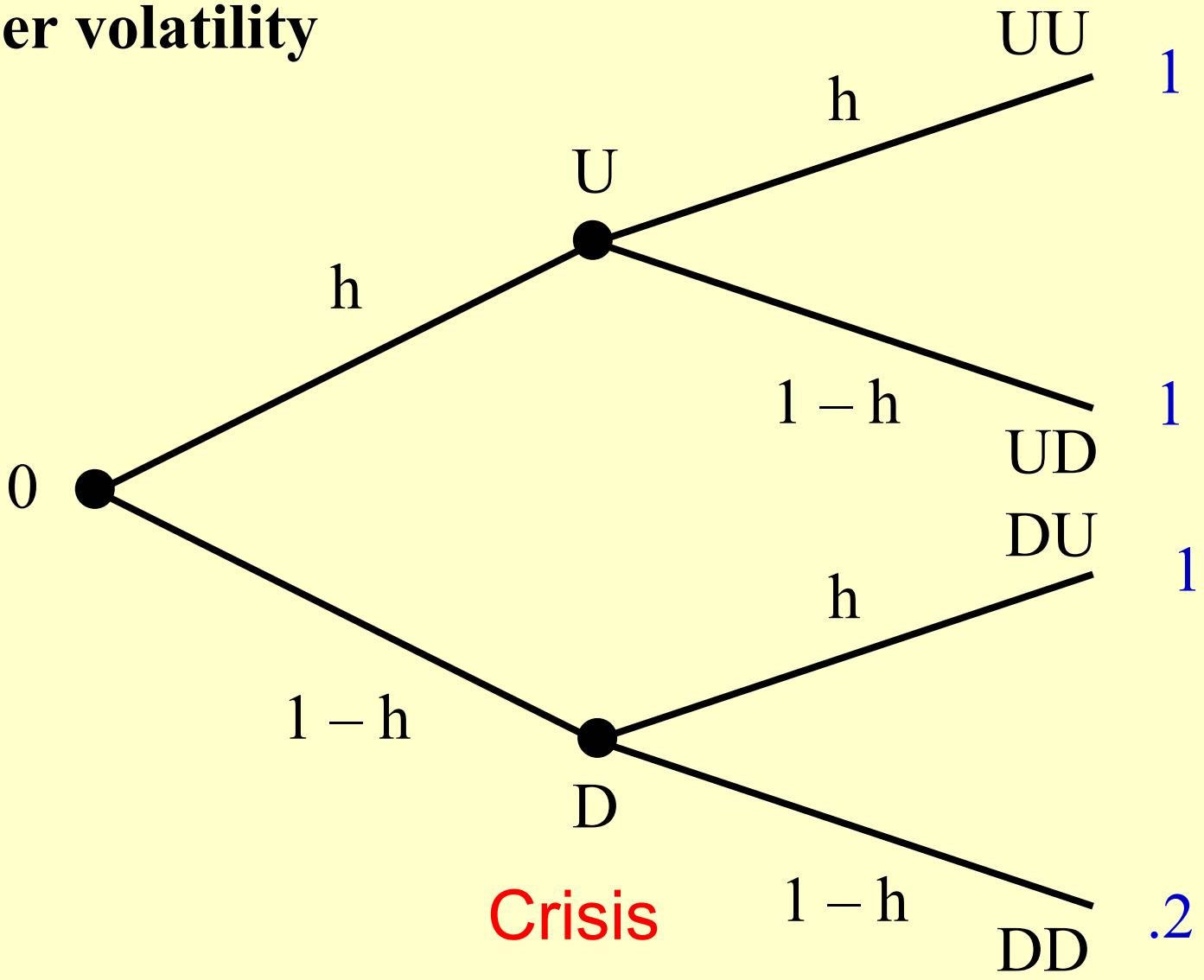
v) This causes huge loss in its value via forced sales.

vi) There may be spillovers if sales of other assets forced.

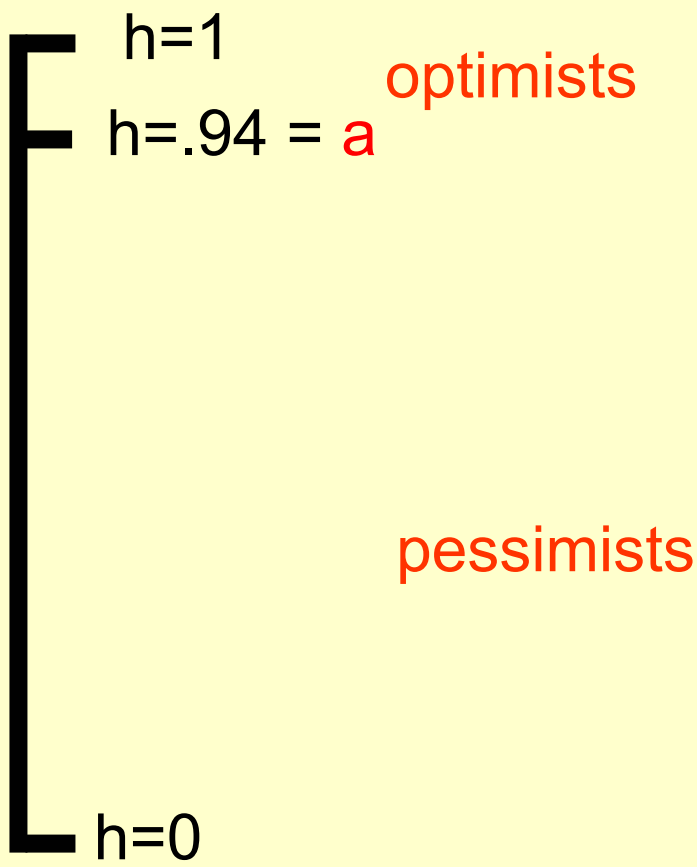
vii) Investors who remain have great opportunity

At D lower expectation

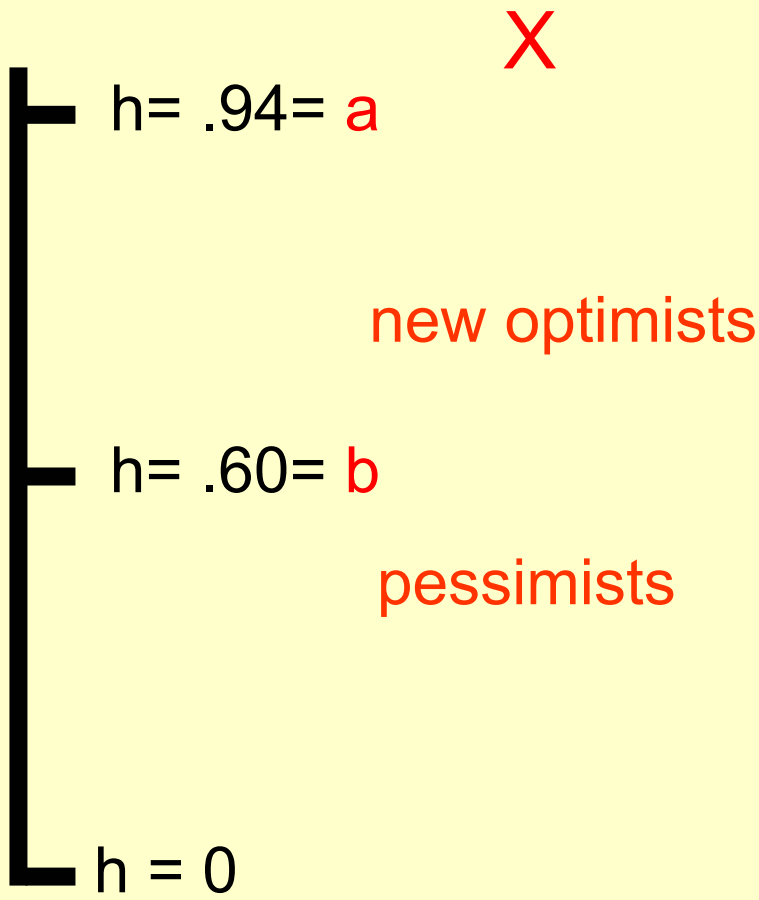
Higher volatility



State 0 Marginal Buyer



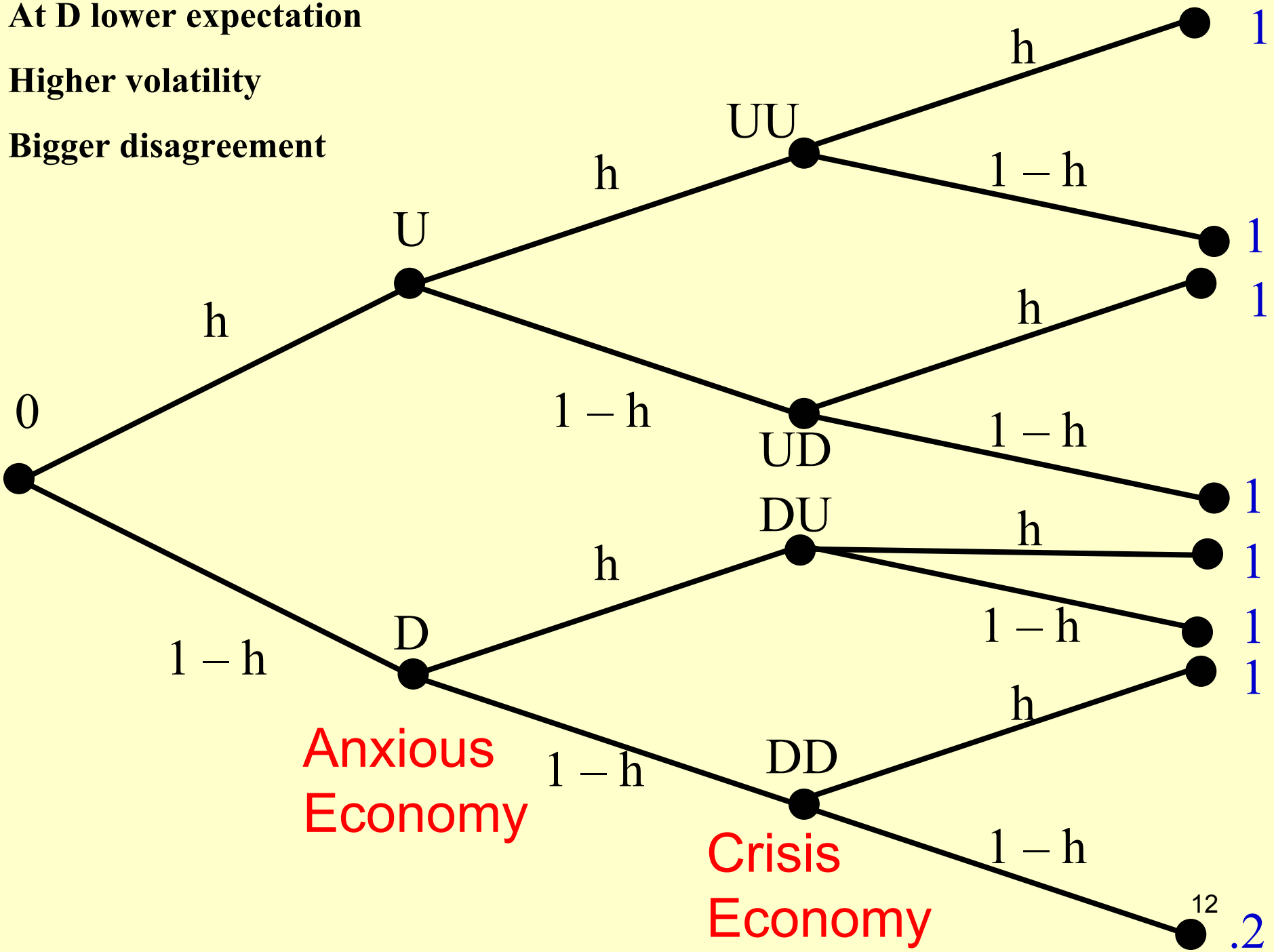
State D Marginal Buyer



At D lower expectation

Higher volatility

Bigger disagreement



Subprime Crisis

- Problem hasn't happened yet – losses = 1% so far. Time to help.
- Markets expecting 25% losses = .5 foreclosures x 50% losses
- This is after government announcements of help
- So much incentive to help, so little help from private sector.

Anxious Economy

- Crisis is rare event – say every 5 or 10 years.
- But margins get tightened much more frequently on milder bad news.
- Anxious economy happens more often.
- Margin tightening less severe. Price drops smaller.

Anxious Economy Continued

- In the anxious economy the most optimistic buyers are not forced to sell their bad news assets.
- In fact they buy more, because they see bigger opportunity (disagreement has increased).
- Where do they get the money to buy? From selling other assets. Thus get Contagion. Assets with no news fall.

Flight to Liquidity

- Liquidity preference goes up when liquidity declines, say because volatility increases and margins tightened
- Then the collateral value of assets on which one can borrow goes up. Thus flight to liquidity.
- Assets on which it is hard to value fall more in price. Thus flight from illiquidity.

To sum up:

Endogenous margins requirements can cause, through what we call the *leverage cycle*
liquidity shortages, and also crises and crashes
in equilibrium.

Geanakoplos(2003)

Endogenous Collateral with Heterogeneous Beliefs: A Simple Example

Let each agent $h \in [0,1]$ 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.

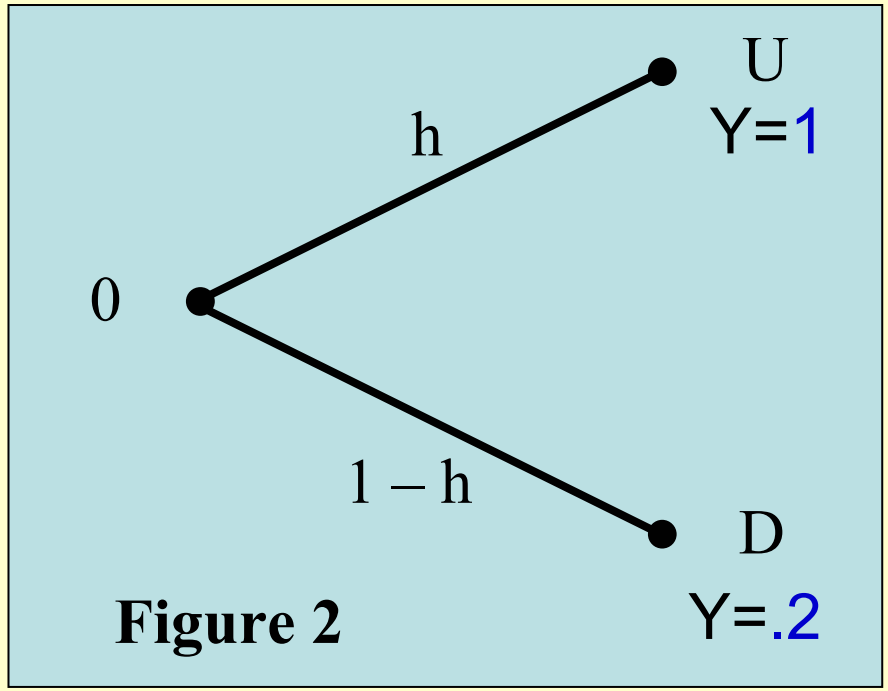


Figure 2

Suppose that X is perfectly durable if warehoused and extinguished if consumed (like tobacco). Suppose that 1 unit of Y gives 1 unit of X in state U and $R=.2<1$ units of X in D.

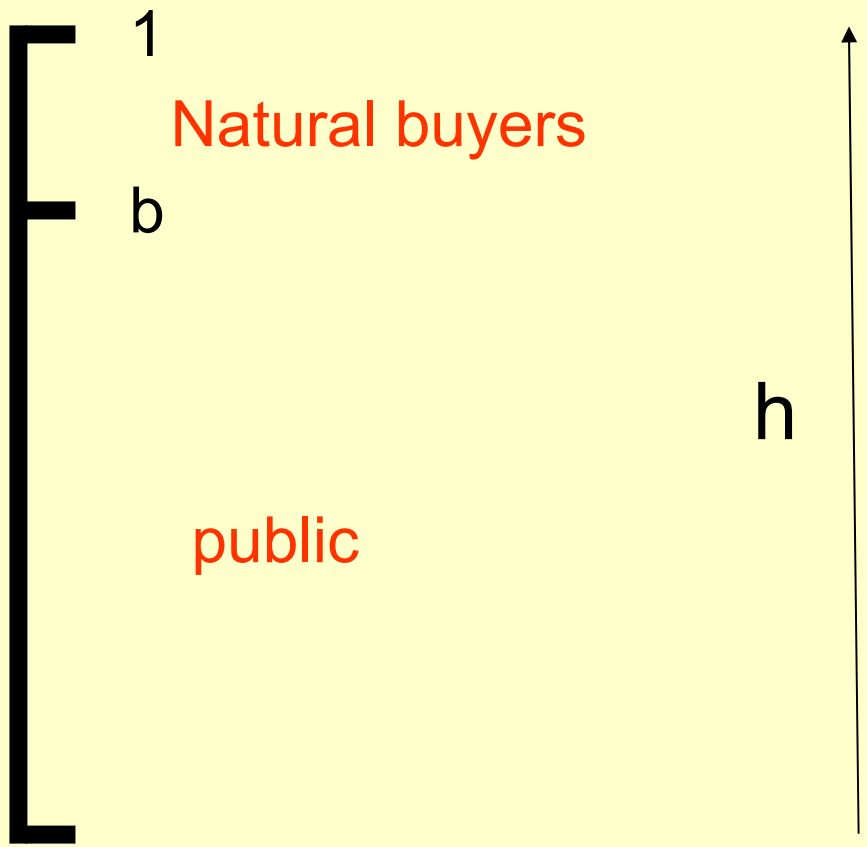
Simple example

- X is cigarettes, utility 1 if consumed at any time (no impatience), perfectly durable
- Y is tobacco plant, produces 1 cigarette in good state s=U, R<1 in bad state s=D.
- All agents $h \in [0,1]$ begin with 1 unit of Y and 1 unit of X at time 0, with no new source of income.
- Heterogeneous beliefs: agent h attaches probability h to good state.

Equilibrium

- Clearly p_Y will be between 0 and 1, since optimists think it is worth 1 and pessimists 0.
- Biggest optimists h=1 will be dying to get their hands on Y, since they will regard it as a sure arbitrage.
- So will get all h > b as buyers, and all h < b as sellers.

Natural Buyers



What are margins?

- Suppose all loans promise 1 cigarette in both states.
- How much will you be able to borrow using one factory as collateral in equilibrium?
- Would think big optimists would be willing to pay higher interest in order to use less collateral, so maybe many contracts actively sold. But NO! Just one contract.

Equilibrium Margin

- Just one contract will be traded, the one where 1 factory collateralizes a promise of .2.
- In this example it happens to be the maximal borrowing that has no chance of default.
- Borrowers are agents $h > b$, and lenders are agents $h < b$.

Why Just One Collateral

- If no more delivered in D, and more is borrowed, then much more must be delivered in U.
- But that means the borrower is paying more in the state U he is almost sure will happen, and the lender is receiving money in a state he is almost sure will not happen. No deal!

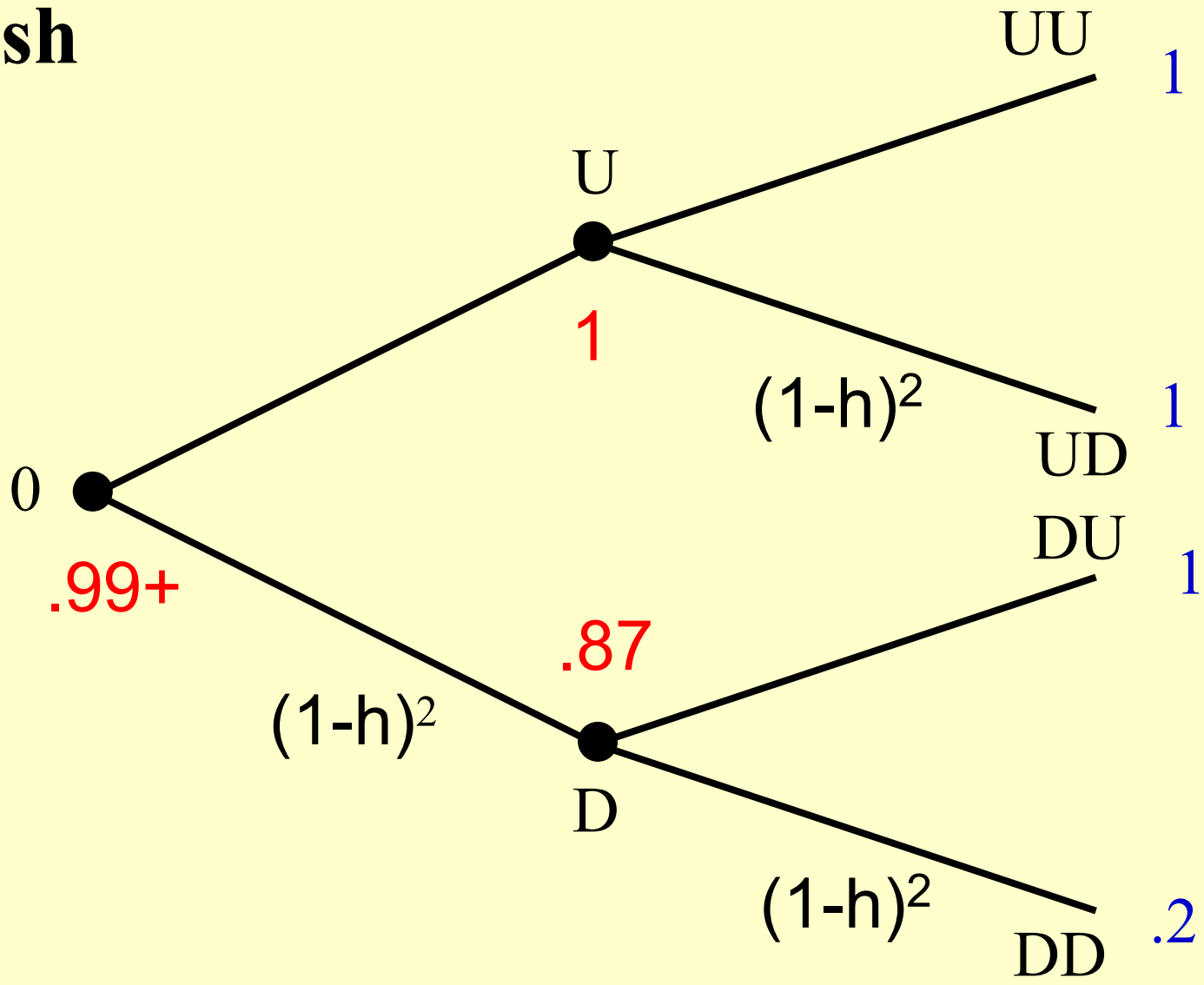
Multi-period example

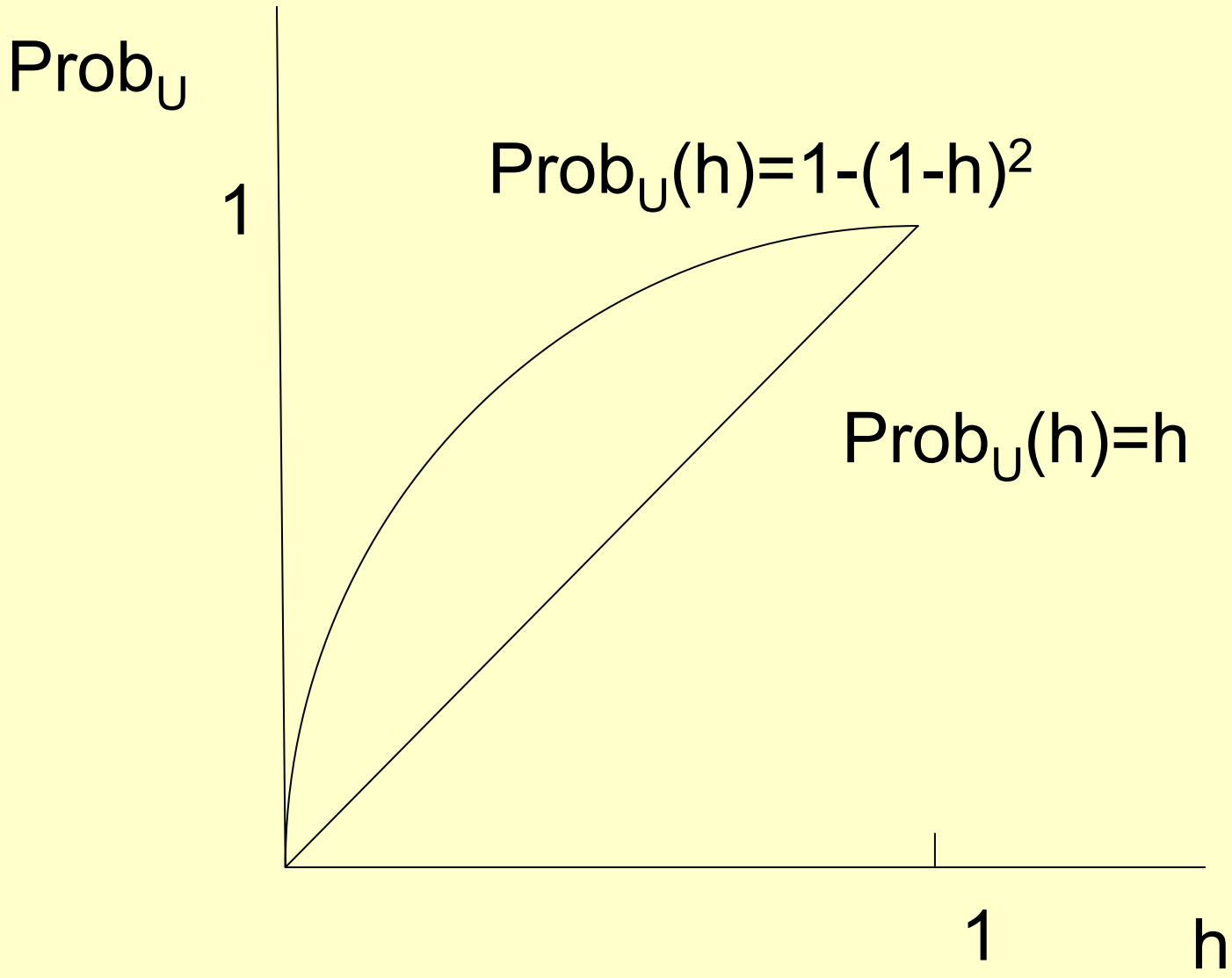
- Now suppose it takes two bad pieces of independent news to get Y=.2, and the news comes sequentially.
- Same model as before; every agent begins with 1 unit of X and 1 unit of Y. But now production takes two periods. Loans are still for just one period.

Equilibrium Margins

- Equilibrium margin at each node.
- Much tougher at D than at 1 or at U.

Crash




Prob_U
1
Prob_U(h)=1-(1-h)^2
Prob_U(h)=h
1
h

What caused crash?

- Because probability of getting .2 goes up, according to a from negligible to .0036.
- Because top 6.4%=1-a got eliminated.
- Because margin tougher.

- Need all three factors: if only have one, get negligible drop in price, e.g.
  - if bad news from beginning, or
  - if eliminate top 6.4% of people from beginning, or
  - if have tough margins at beginning.

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

Geanakoplos-Kubler 2006 (unpublished)
"Pareto Improving Margins"

shows that market forces do *not* necessarily choose *socially optimal margins*. Regulating Margins can make everybody better off.

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

Fostel-Geanakoplos 2007 (unpublished)
"Emerging Markets in an Anxious Global Economy: Contagion, Flight to Liquidity, and Issuance Rationing"

shows that with
multiple assets, in an *anxious economy*
endogenous margins also can explain *contagion* and
flight to liquidity.

Anxious Economy

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End

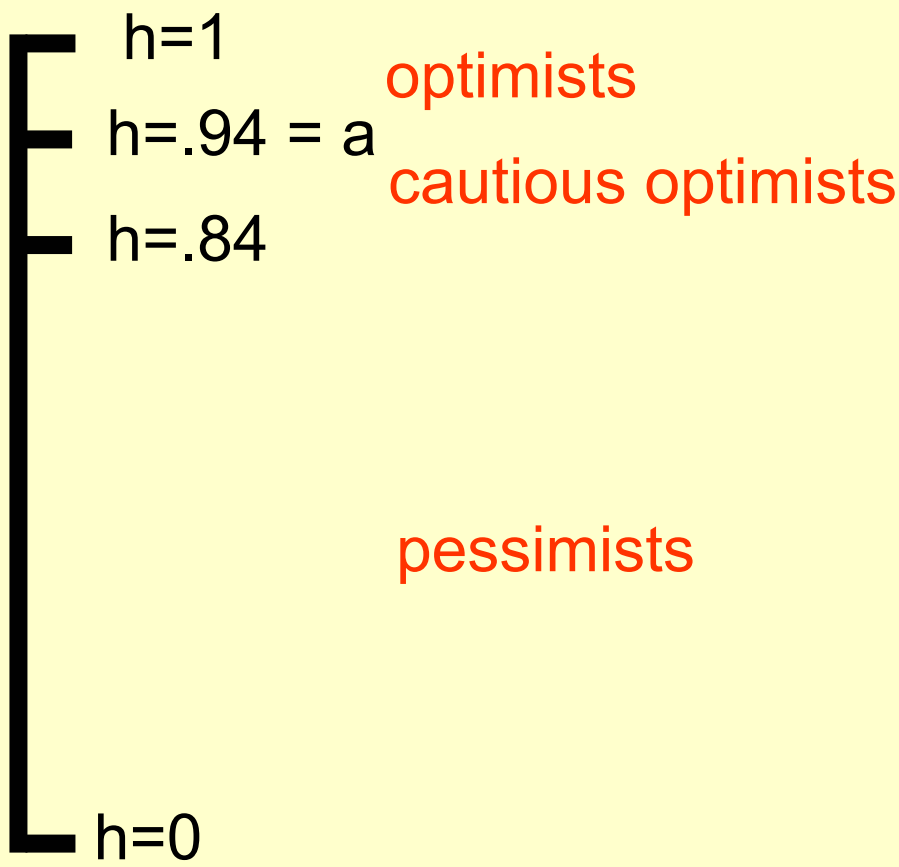
Back up slides

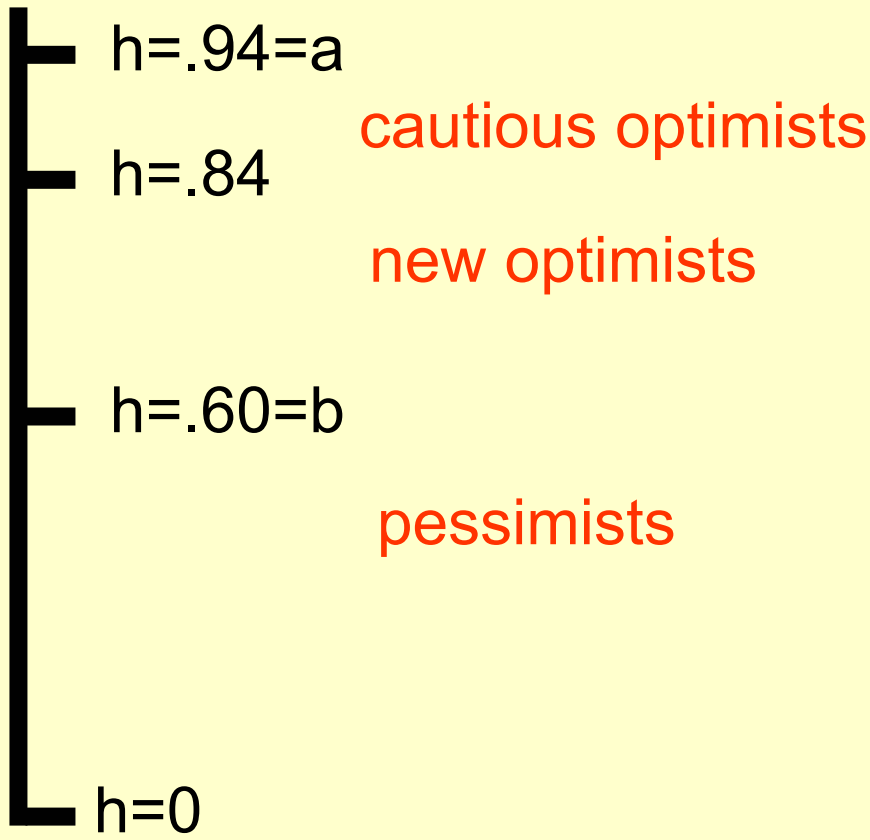
Cautious Speculators

- Might have thought crash impossible with rational expectations. Where are agents who wait to buy until after the crash?
- After crash optimistic investors could make far greater returns than before. Agent a thinks he could make expected (leveraged) return of 18% starting at s = D.
- Why don't investors wait to invest until D, thereby eliminating the crash?

Cautious Speculators

- In fact some do wait. Agent a computes that his return on $1 of Y is greater than of consuming $1 of X immediately, namely 1.00075. He does not invest in Y,though he is risk neutral. Why? Because he is waiting for D. In other words, his marginal utility of X is also 1.00075, because he will save X into D in order to buy Y there.
- So few agents behave this way,since probability of D so low, that not enough to stop the crash. These agents must be optimistic if D, but that means they think D unlikely, so not worth waiting for it.


h=1
optimists
h=.94 = a
cautious optimists
h=.84
pessimists
h=0


h=.94=a
cautious optimists
h=.84
new optimists
h=.60=b
pessimists
h=0