**Brunnermeier and Oehmke**

The chapter does not give a clear distinction between financial crises and bubbles. While they are both interlinked, they do not clearly separate one from the other.

They also do not give clear definition of what a bubble is, because there are several. But here are the common patterns they describe:

* Initial innovation, technology or change that results in an increase in fundamental value of that asset
* Run up phase (typically of low volatility) of increase in price, eventually above fundamental value
* Euphoria phase of explosive growth and high volatility
  + Note: important observation is that rational players (the ones that have knowledge of a mispricing) do not usually lean against the bubble, but rather ride it for sometime and then exit it before the crash
* Eventual sharp price correction
* Crisis caused by the imbalances creted by the bubble which had distortionary effects on agents
* Usually, the crisis is amplified by several mechanisms related to systemic risk

*Note on cryptoassets:*

* Their movement in 2020-2022 is the typical description of a bubble
  + However, it is very difficult to claim there is a bubble because it is very difficult to assess the fundamental value of a crypto (or of any asset as I will comment later)
* The value of any crypto can come exclusively from one of the following sources:
  + Convenience: there is value for the agent in using the cryptocurrency for transactions. For example thanks to its anonymity. Or thanks to it being more efficient for some transactions. Or due to it being the way to access some services (like crypto investment opportunities. Example: you need Ethereum to buy ERC20 tokens). Another example: big companies that want to attract customers paying in Bitcoin buy Bitcoin reserves to be able to handle operations (Paypal, Mastercard, Tesla, Microsoft).
  + Hedge/Insurance: a crypto might be the most efficient way of hedging a risk or the most efficient insurance for some agent. For example: a hedge fund finds that Bitcoin helps diversify some undiversifiable risk in a portfolio of traditional securities. (Several Hedge Funds do this). Or for example, buying Bitcoin through binance might be the most cost efficient way of hedging against inflation for a 18 year old that does not understand the bond market, or that cannot access inflation protected securities.
  + Speculation: buying because you expect someone to buy it at a higher price in the future. Any trading strategy like convergence trades, arbitrages, personal bets, … enter here. (Most retail investors and many hedge funds mainly invest because of this reason).

Now I present the different types of theories and evidence explaining why financial bubbles emerge.

1 RATIONAL BUBBLE MODELS (with complete info)

* Called “rational” because maximizing individuals generate them
* Main idea:
  + Infinitely lived agent. Rational profit maximizer.
  + p\_t = E\_t [ ( p\_{t+1} + d\_{t+1} ) / (1+r) ]
  + Rewrite: p\_t = PV(dividend stream until T) + PV(resale price at final period T)
  + For assets with infinite horizon (like equity or cryptocurrencies):
    - If transversality condition met: lim (T -> inf) PV(resale price at T) = 0
    - Then unique solution p\_t = PV(dividend stream) = v\_t (denoted v\_t and called “fundamental value”)
    - If transversality condition does not hold, there are infinite solutions for p\_t. One is p\_t = v\_t. And then infinite corresponding to different values of the second component, denoted b\_t and called bubble.
      * p\_t = v\_t + b\_t
* Main model (Blanchard and Watson 92):
  + Bubble term has probability (1-\pi) of going to 0 in any given period, and survives otherwise with probability \pi.
  + From p\_t formula, you can get b\_t = E\_t [ b\_{t+1} (1+r)^(-1) ] = \pi\_t b\_{t+1} (1+r)^(-1)
  + Then b\_{t+1} = b\_t \* [(1+r) / \pi] which implies exponential growth
    - NICE. It is what is observed in the data
  + What are the problems?
    - If at any moment b\_t is 0, then b\_{t+1} is zero. Then bubbles in this model can only progress, not emerge endogenously.
    - Bubbles have fundamentally zero value. The sale of an asset with a bubble is a zero sum game for the part b\_t part of the price (the seller gains everything the buyer overpays). Therefore, in a Pareto efficient situation, there cannot be bubbles because there cannot be trading of overpriced assets.
      * Will be solved introducing incomplete information.
    - And other rational shortcomings. For example, the bubble grows at rate that is higher than the growth rate of GDP if r>g. Then you need to impose r<g on average. May not be realistic.
      * The r<g is descriptive in which there is an excess investment in capital. This is a feature of some of the next models (which are a bit more realistic)

2 OLG Models (subgroup within rational models with complete info)

* (Tirole 1985)
  + In OLG Models, inefficient allocations may arise.
  + The golden rule for a OLG model (optimal allocation) is one such that real interest rate is equal to growth rate of the economy (that of productivity).
  + You can show in macro models with incomplete markets (that means, when there are not Arrow Debreu securities for each contingency), risk averse households with borrowing constraints do excessive saving (precautionary saving).
  + That results in excessive investment in capital
  + Tirole shows that a bubble can crowd out investment from capital and make the allocation efficient.
  + What are the problems?
    - According to the model, when the bubble bursts, you should see a lot of money going back to investment in capital.
    - In reality, the opposite happens. All investment goes down after a bubble bursts.
  + Models with any type of precautionary saving (not necessarily OLG) of other authors also reason in the same way. They show that assets that allow to store value for next period (bonds, cash, … any type of imperfect insurance) will be overpriced from a rational point of view.
* Herding behavior
  + Interestingly, when you add a component of relative wealth in the utility function (agents care about how rich they are in comparison with other agents), you can induce herding behavior in OLG setting.
  + The bubble can arise, and then some households are getting richer for next period.
  + In this setting, either you buy now, or you don’t buy. Only two periods of life.
  + When a lot of people start buying the bubble, and the expectations of others is that they might sell the asset at a high gain, then agents start also buying the bubble.

3 INFORMATIONAL FRICTIONS

* Noise trader risk models
  + Some of the previous models include noise trader risk.
  + There are noise traders. They invest irrationally, or just miss information, or have other motives besides maximizing trading profit (for example they need liquidity). And they are mostly unpredictable. Usually, they keep buying the bubble.
  + Rational investors refuse to arbitrage due to the uncertainty of how long they will need to hold their position until the bubble bursts. They may not be able to hold the position long enough
  + This will appear in more models.
* Pure risk because of information uncertainty
  + In rational models of bubbles agents know dividends and optimal price
  + However, even rational arbitrageurs have uncertainty. They may decide to trade in a rational way based on expectations and still be wrong if the uncertain fundamental value of the asset changes in an unexpected way.
    - Example: some people were saying NVIDIA was a bubble early in its price rise, which was true based on expectations. And then dividends continued increasing beyond expectations for a while.
* Abreu and Brunnermeier (2003)
  + This one is super popular in research. Even I had heard about it before reading about bubbles.
  + It basically shows that some rational traders find it optimal to ride the bubble rather than just try to burst it because it is overpriced.
    - This is very powerful when combined with another famous paper: Brunnermeier and Nagel (2004) where they empirically show that big hedge funds rode the tech bubble in 2000.
  + Earlier models had already shown that noise trader risk of irrational (or uninformed) investors buying the bubble was sufficient to have rational traders riding the bubble for some time.
  + In Abreu and Brunnermeier (2003) they compound this: now its also the expectations that rational investors are going to ride the bubble which also motivates to ride the bubble further. (Actually, they just ignore noise traders)
  + Model:
    - There is an ongoing increase in fundamental value of an asset during 10 periods. Then its value stays constant.
    - The traders are made to realize sequentially over several periods that the price is above fundamental value. Only after period 40 do all traders know that there is a bubble.
    - Critically, no investor knows when his peers have realized that there is a bubble, or if they have realized yet. -> The presence of a bubble is never common knowledge.
    - Critically also, no single trader can burst the bubble. The coordination of several traders is needed.
    - The problem of the traders is to maximize profit. So to ride the bubble as long as possible while not suffering the burst. This results in an optimal number of periods of holding the bubble for each investor.
    - The result is a bubble that survives beyond period 40.
      * An extension (Doblas-Madrid 2012) endogeneize the price process. Instead of being exogenous prices, they are determined by the traders themselves.
      * He finds that the more uncertainty about the price, the more volatile it is and the longer the bubble can survive.
  + Probably, by extending models like this you can easily show that when there is some event that gives any minimal common knowledge that allows to infer a higher probability of a bubble, sales might cascade and burst the bubble.
    - Cutler, Poterba, Summers (1989) show that most big stock price changes in the US market cannot be attributed to news about significant changes in the fundamental value of the stocks.

3.4 DELEGATED INVESTMENT AND CREDIT BUBBLES

Main idea:

* People are short term oriented and pull off money from funds when their returns are not good.
* This prevents hedge funds from arbitraging long term, and on the contrary motivate them to ride the bubble
* Most popular model is Schleifer and Vishny (1997). Another one that I had heard of before reading about bubbles.

Other models focus on credit bubbles. But they are just applications of the models of corporate finance where managers do risk shifting to debt holders.

3.5 HETEROGENEOUS-BELIEFS BUBBLES

Departure:

* Previous model assume all agents are the same, just with different information. Therefore they act different.
* In heterogeneous belief models, you have agents with different beliefs. There can be a bubble even in Pareto setting because agents just want to optimally hold different amounts of the assets due to their different beliefs.

Many models but all with the following characteristics:

* (1) Heterogeneous beliefs agents. Some think the price is higher, and are more confident about it. (You characterize with priors. A smaller variance prior around a higher mean)
* (2) Short selling constraints. You restrict the ability of traders with beliefs on a smaller price to short sell the asset. As a result, the price only increases.
* (3) Rational agents ride the bubble. Knowing the previous two, some agents may hold the asset even at a price they consider too much because they believe they can sell it to an even more optimistic trader.
* Empirical support:
  + These models predict large increase in price AND trading volume. And that is more pronounced, the more scarce the asset is.
  + All are supported by several empirical papers.
* Implications for systematic risk:
  + If you expand the model with credit, then when the bubble bursts, agents have to fire sell their holdings. Causing margin/collateral calls and more sales.
  + In the end, the ones that have to end up buying the asset are the ones that had not bought it before. The ones that had the lowest price beliefs. Excessive (inefficient) sale and low price.

3.6 EMPIRICAL EVIDENCE ON BUBBLES

One can always argue that the fundamental price of an asset with payoff uncertainty is bigger than what others say. It is difficult to clearly show that an asset is priced as a bubble because there can always be some fundamental behind it.

* Empirical papers focus on flagrant mispricings to show bubbles:
  + Lamont and Thaler (2003). (And there are many similar papers using the same principle). But this paper is very popular. Had also heard of it before.
    - Palm and 3Com where different companies.
    - 3Com owned Palm and spinned it off.
    - They sold 5% Palm on an IPO. The resulting price was (roughly) 100 euros per Palm share.
    - Together with an IPO, they released plans to give the remaining 95% of Palm to 3Com shareholders, at 1.5 shares of Palm per share of 3Com. So each 3Com share had an implicit value of 150 euros, plus whatever the rest of the business of 3Com is worth.
    - However, 3Com share price closed on 80 (approx).
  + The paper is more about financial mispricing and how short selling constraint (frictions in general) affects it. But shows that you need obscene examples like this to undoubtedly show there is a bubble.

These smart guys managed to go further:

* Diba and Grossman (1988) If p\_t = v\_t and dividends follow unit root, then p\_t must also follow unit root. But p\_t – v\_t = p\_t – d\_t/r (assuming equity. Infinite horizon). Then just test if p\_t – d\_t/r is stationary.
  + Cannot be rejected.
  + Some critiques. Evans (1991) -> Bubbles that go up exponentially and burst periodically (stocks could fit that pattern) are not detected by the previous test.
* West (1987)
  + Express p\_t = (p\_{t+1} + d\_{t+1})/(1+r) + b\_t
  + Use d\_t as an instrument for (p\_t{t+1}+d{t+1})
    - There is correlation between b\_t and (p\_{t+1} + d\_{t+1}) (so between epsilon and X). Because b\_t also depends on expectations of p\_{t+1}.
    - d\_t is not correlated with b\_t. (Theoretically at least) (EXOGENOUS 😊)
    - But it is correlated with p\_{t+1} + d\_{t+1}. I guess because of serial correlation of dividends.
  + They find 1/1+r estimate -> Estimate of r
  + Then they express the divideds as an AR(1) process d\_t = \phi d\_{t-1} + \epsilon
  + They estimate phi
  + IF p\_t = v\_t then p\_t = ( [\phi] / [1+r-\phi] ) d\_t. Regress p\_t on d\_t (directly). From your estimate, obtain \phi using your previous r estimate.
  + Null hypothesis is that both \phi estimates are the same.
    - REJECTED (:O)

Finally you have experimental economics. Put students in a lab and see what they do.

* Basically, they see patterns that match the bubble patterns observed (at least, the experiments they publish show that).
* People in these articles hardly do basic math to determine what the fundamental value of easy to price securities is. Then they often overpay.
* The more rational ones tend to ride the bubble despite knowing the mispricing.
* Comment: in general, it seems that in experiments you have stupid people buying whatever based on intuition and feeling while smart guys profiting on that rather than buying the fundamental value like robots.
  + Rational bubble models with all equal agents do not fit these experiences. Heterogeneous agents with different beliefs/information fit much better.

**QUESTIONS TO DISCUSS**

1 What financial markets are under researched?

2 Which episodes resemble bubbles (roughly)

3 Reading at news and thinking about it, what is roughly the apparent cause of the bubble episode?

4 Which theoretical models could fit the episode? Under what conditions?

5 How would we test those theories based on expected patterns and required conditions?

6 What have other papers done before? What are the gaps in the literature that should be filled?: (1) what have they done badly? (2) What have they not yet done

7 Based on (5) and (6), what would we ideally do?

8 What data do we have? Are we able to manage it? What methods/tests could we use?

9 What is the closer we can get to what we want to do? Is it viable?

10 Is there any other better gap in the literature that we can fill using that data?

11 What professors from the department can be helpful?

Ideally we want to fill a gap in the literature, document new facts. If we manage to do that, we have a paper. If in addition we have a model extension or new model that explains the new documented facts, we have a second paper.