

# Lecture 13: Theory of Asset Pricing III

## Asset Price Bubbles

---

Adam Hal Spencer

The University of Nottingham

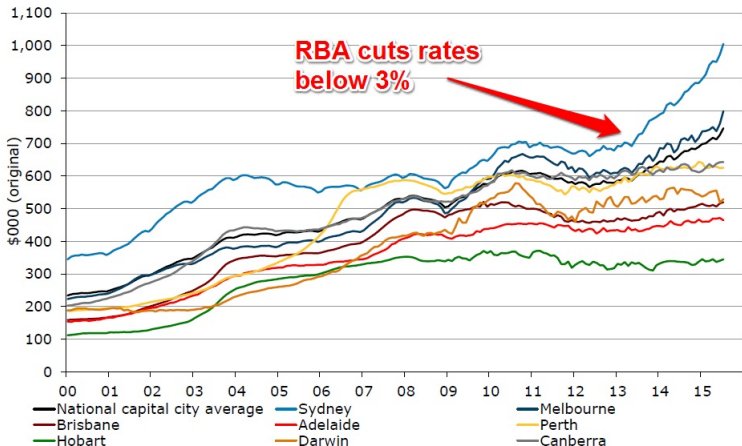
Advanced Financial Economics 2019

# Roadmap

- 1 Introduction
- 2 Symmetric Information
- 3 Asymmetric Information
- 4 Conclusion

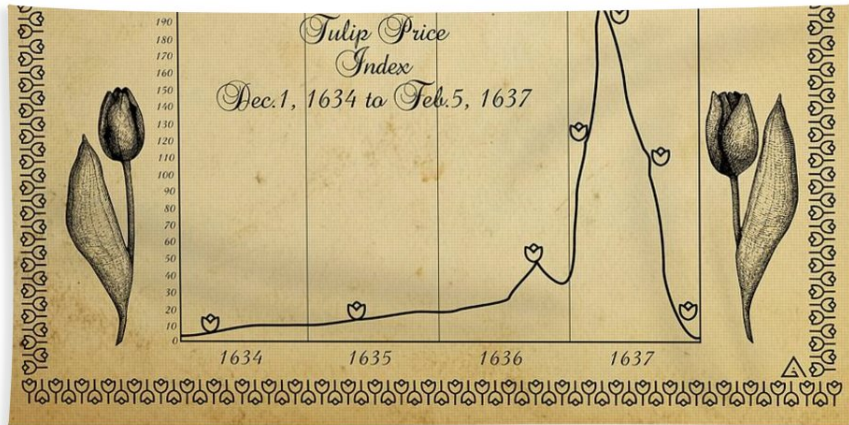
# Motivation

**FIGURE 2. DIVERGENCE ACROSS STATES AND TERRITORIES BROADENS**



Source: RP Data, ANZ Research

# Motivation



# Motivation

- The market for North American-trained economics Ph.D. graduates.
- Some of my friends from Wisconsin:
  - Mr. Pink: consulting firm (\$300,000 USD/year plus bonuses).
  - Mr. Blond, Mr. Blue and Mr. White: tech company (\$200,000 USD/year plus stock options).
  - Mr. Green: investment bank (\$250,000 USD per year).
- Really...?
- There are always exceptions obviously: yours truly still drinks Tesco-brand wine.

# Motivation

- We'll define bubbles as when an asset's price **exceeds its fundamental value**.
- What's an asset's fundamental value?
- Are bubbles rational?
- When do they happen?

# Motivation

- Neoclassical v.s. behavioural economics.
- Do bubbles come about in the presence of rational agents or not?
- When else might they come about?

# Roadmap

- 1 Introduction
- 2 Symmetric Information**
- 3 Asymmetric Information
- 4 Conclusion



# Setup

- Consider the infinite-horizon consumption-savings problem with a risky asset and a risk neutral agent.
- What does this mean in terms of utility function? A risk neutral agent?

# Solution

- Household solves the problem

$$\max_{\{c_t, a_{t+1}\}_{t=0}^T} \mathbb{E}_0 \sum_{t=0}^T \beta^t c_t$$

subject to

$$c_t + p_t a_{t+1} \leq (p_t + d_t) a_t + y_t$$

where  $y_t \geq 0$  is the investor's endowment of income for the period.

# Solution

- Euler equation given by

$$1 = \beta \mathbb{E}_t \left[ \frac{p_{t+1} + d_{t+1}}{p_t} \right]$$

# Solution

- Iterate forwards on the Euler equation

$$\begin{aligned}p_{t+1} &= \beta \mathbb{E}_{t+1} [p_{t+2} + d_{t+2}] \\ \Rightarrow p_t &= \beta \mathbb{E}_t \{d_{t+1} + \beta \mathbb{E}_{t+1} [p_{t+2} + d_{t+2}]\} \\ \Rightarrow p_t &= \mathbb{E}_t \sum_{s=1}^{T-t} \beta^s d_{t+s} + \beta^{T-t} \mathbb{E}_t [p_T]\end{aligned}$$

# Finite v.s. Infinite Horizon

- Recall

$$p_t = \mathbb{E}_t \sum_{s=1}^{T-t} \beta^s d_{t+s} + \beta^{T-t} \mathbb{E}_t [p_T].$$

- Notice that if we have  $T < \infty$ , then  $\mathbb{E}_t [p_T] = 0$  as the asset **dies** at the end of time.
- Not so obvious when it comes to the infinite limit, however.

# Finite v.s. Infinite Horizon

- To rule-out bubbles, we need the so called **transversality condition** to hold

$$\lim_{T \rightarrow \infty} \beta^{T-t} \mathbb{E}_t [p_T] = 0$$

- This need not hold though!

## Finite v.s. Infinite Horizon

- We're considering a difference equation.
- Any solution can be decomposed as

$$p_t = \mathbb{E}_t \underbrace{\sum_{s=1}^{T-t} \beta^s d_{t+s}}_{\text{Fundamental value}} + b_t \quad (1)$$

which are the fundamental value (PV of dividends) and the bubble component respectively.

- Where [you need **not** show this], it must be that

$$b_t = \mathbb{E}_t [\beta b_{t+1}].$$

## Finite v.s. Infinite Horizon

- $p_t = \mathbb{E}_t \sum_{s=1}^{T-t} \beta^s d_{t+s}$  is only **one** solution to the equation (1).
- A non-zero value of  $b_t$  reflects the existence of a **rational bubble**.
- A self-confirming belief that the bubble's price doesn't conform to the fundamental value.



## Finite v.s. Infinite Horizon

- But this is weird...why?
- There is some asset that trades for a price above what it delivers to us in future dividends.
- This only happens because agents know it will have the bubble component still in the future.
- Will be able to sell the asset for a price above fundamental value.
- This is kinda scary stuff...
- People paying more than something is worth because they think it will still be the case in the future.

## Finite v.s. Infinite Horizon

- For this to be a solution, what restrictions must we place on  $b_{t+1}$ ?
- For the price  $\lim_{t \rightarrow \infty} p_t < \infty$ , we need for the bubble component to grow at the same rate as the discount factor.
- I.e. if  $\beta = \frac{1}{1+r}$ , then  $b_t$  must grow at rate  $r > 0$ .

## Finite v.s. Infinite Horizon

- Why do I not refer to the case where  $b_t \rightarrow \infty$  as a bubble solution?
- An infinite number isn't a solution, (it's undefined by definition).
- Bubbles here happen when an asset's price sits above its fundamental value.

# Roadmap

- 1 Introduction
- 2 Symmetric Information
- 3 Asymmetric Information**
- 4 Conclusion

# Intuition

- What if some people have information that others do not?
- What role do prices play here?
- Prices reveal scarcity of the resource as well as revealing information about **other traders'** information.
- Lots of different equilibria can be sustained in these models, provided that people remain asymmetrically informed even after inferring things from observing prices.
- If I suddenly learn that an asset is over-valued, then I won't trade for it anymore at the prevailing price: equilibrium breaks-down.

# Roadmap

- 1 Introduction
- 2 Symmetric Information
- 3 Asymmetric Information
- 4 Conclusion**

# Takeaways

- In infinite time models, rational bubbles can emerge.
- In the symmetric information case, it's all about the limit term on the price!
- With differential information, it's more about people being in the dark and staying there!