

Bubbles

Econ 434 Lecture

Barry W. Ickes

The Pennsylvania State University

December 2008

Bubbles

- A bubble is a situation where asset prices move because they are expected to move.

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Bubbles

- A bubble is a situation where asset prices move because they are expected to move.
- In a bubble the price moves away from fundamentals based solely on expectations of further movements.

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Bubbles

- A bubble is a situation where asset prices move because they are expected to move.
- In a bubble the price moves away from fundamentals based solely on expectations of further movements.
 - Expectations become *self-confirming*.

Bubbles

- A bubble is a situation where asset prices move because they are expected to move.
- In a bubble the price moves away from fundamentals based solely on expectations of further movements.
 - Expectations become *self-confirming*.
- Examples abound

Bubbles

- A bubble is a situation where asset prices move because they are expected to move.
- In a bubble the price moves away from fundamentals based solely on expectations of further movements.
 - Expectations become *self-confirming*.
- Examples abound
 - housing bubble, telecoms bubble, tulipmania, South Sea Bubble

Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- A bubble is a situation where asset prices move because they are expected to move.
- In a bubble the price moves away from fundamentals based solely on expectations of further movements.
 - Expectations become *self-confirming*.
- Examples abound
 - housing bubble, telecoms bubble, tulipmania, South Sea Bubble
 - In Tulipmania, for example, a Semper August bulb sold for 2000 guilders in 1625 (avg annual income \approx 150 guilders), an amount of gold worth \$16,000 at \$400/oz., 5500 guilders in 1637

Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- A bubble is a situation where asset prices move because they are expected to move.
- In a bubble the price moves away from fundamentals based solely on expectations of further movements.
 - Expectations become *self-confirming*.
- Examples abound
 - housing bubble, telecoms bubble, tulipmania, South Sea Bubble
 - In Tulipmania, for example, a Semper August bulb sold for 2000 guilders in 1625 (avg annual income \approx 150 guilders), an amount of gold worth \$16,000 at \$400/oz., 5500 guilders in 1637
 - contract price of tulips in early February 1637 was about 20 times higher than in both early November 1636 and early May 1637.

Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- A bubble is a situation where asset prices move because they are expected to move.
- In a bubble the price moves away from fundamentals based solely on expectations of further movements.
 - Expectations become *self-confirming*.
- Examples abound
 - housing bubble, telecoms bubble, tulipmania, South Sea Bubble
 - In Tulipmania, for example, a Semper August bulb sold for 2000 guilders in 1625 (avg annual income \approx 150 guilders), an amount of gold worth \$16,000 at \$400/oz., 5500 guilders in 1637
 - contract price of tulips in early February 1637 was about 20 times higher than in both early November 1636 and early May 1637.
- perhaps that is why we refer to panics, mania, etc.

Tulipmania

Lecture Note

Ickes

- Was this really a bubble?

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?
- Fundamentals Explanations are possible

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?
- Fundamentals Explanations are possible
 - mosaic virus in rare bulbs made them non-reproducible

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?
- Fundamentals Explanations are possible
 - mosaic virus in rare bulbs made them non-reproducible
 - In Nov 1936 futures contracts were converted to options

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?
- Fundamentals Explanations are possible
 - mosaic virus in rare bulbs made them non-reproducible
 - In Nov 1936 futures contracts were converted to options
 - On Feb. 24, 1637, the Dutch florists "announced that all futures contracts written since November 30, 1636 and up until the opening of the spring season, were to be interpreted as option contracts

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?
- Fundamentals Explanations are possible
 - mosaic virus in rare bulbs made them non-reproducible
 - In Nov 1936 futures contracts were converted to options
 - On Feb. 24, 1637, the Dutch florists "announced that all futures contracts written since November 30, 1636 and up until the opening of the spring season, were to be interpreted as option contracts
 - this raises the amount people will pay for the contract, and demand exploded

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?
- Fundamentals Explanations are possible
 - mosaic virus in rare bulbs made them non-reproducible
 - In Nov 1936 futures contracts were converted to options
 - On Feb. 24, 1637, the Dutch florists "announced that all futures contracts written since November 30, 1636 and up until the opening of the spring season, were to be interpreted as option contracts
 - this raises the amount people will pay for the contract, and demand exploded
 - high price was the strike price

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Was this really a bubble?
 - Did a sailor really eat a \$10,000 bulb sitting on a table?
- Fundamentals Explanations are possible
 - mosaic virus in rare bulbs made them non-reproducible
 - In Nov 1936 futures contracts were converted to options
 - On Feb. 24, 1637, the Dutch florists "announced that all futures contracts written since November 30, 1636 and up until the opening of the spring season, were to be interpreted as option contracts
 - this raises the amount people will pay for the contract, and demand exploded
 - high price was the strike price
 - bubonic plague epidemic induced gambling at that time

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble
 - debt-equity swap to retire state debt with corporate shares, financed by trading profits

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble
 - debt-equity swap to retire state debt with corporate shares, financed by trading profits
 - trading profits from state monopolies, in the South Sea trading

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble
 - debt-equity swap to retire state debt with corporate shares, financed by trading profits
 - trading profits from state monopolies, in the South Sea trading
 - prices boomed then crashed

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble
 - debt-equity swap to retire state debt with corporate shares, financed by trading profits
 - trading profits from state monopolies, in the South Sea trading
 - prices boomed then crashed
- Mississippi bubble and John Law

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble
 - debt-equity swap to retire state debt with corporate shares, financed by trading profits
 - trading profits from state monopolies, in the South Sea trading
 - prices boomed then crashed
- Mississippi bubble and John Law
 - similar debt-equity swap combined with Law's simultaneous creation of a state bank

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble
 - debt-equity swap to retire state debt with corporate shares, financed by trading profits
 - trading profits from state monopolies, in the South Sea trading
 - prices boomed then crashed
- Mississippi bubble and John Law
 - similar debt-equity swap combined with Law's simultaneous creation of a state bank
 - trading company in the Mississippi territories

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- South Sea bubble
 - debt-equity swap to retire state debt with corporate shares, financed by trading profits
 - trading profits from state monopolies, in the South Sea trading
 - prices boomed then crashed
- Mississippi bubble and John Law
 - similar debt-equity swap combined with Law's simultaneous creation of a state bank
 - trading company in the Mississippi territories
- Bubble collapses delayed banking for 50 years in each country

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

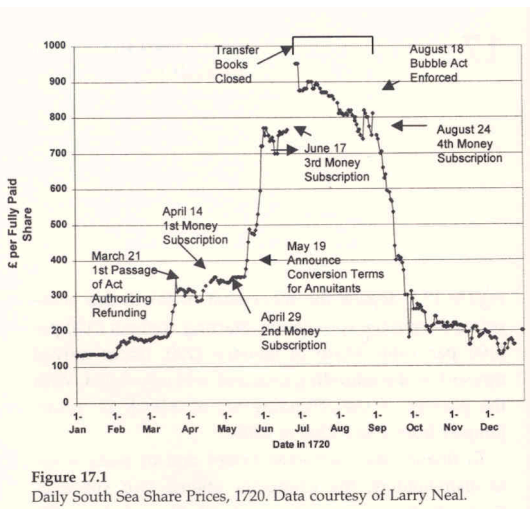


Figure 17.1
Daily South Sea Share Prices, 1720. Data courtesy of Larry Neal.

Figure: The South Sea Bubble

South Sea Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary



Nasdaq bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary



Figure: Nasdaq index

Japan Stock Market Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

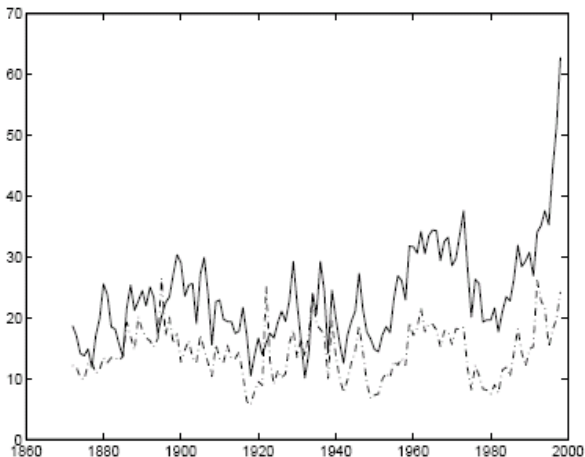
Summary



Figure: Nikkei stock index

US Stock Prices and Earnings

— Price-Dividend Ratio, - - - Price-Earnings Ratio



Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

NASDAQ

Lecture Note

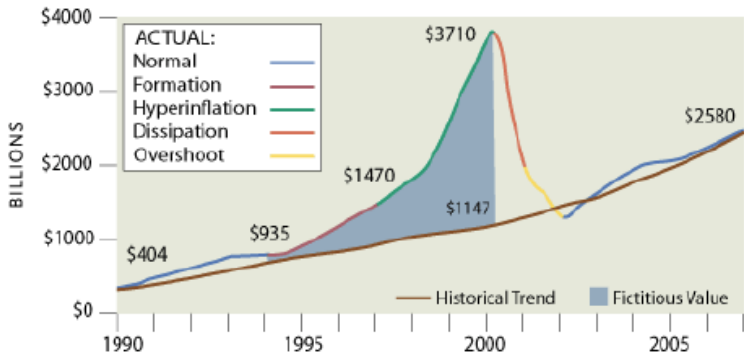
Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary



Total market value: NASDAQ. 11% annual growth derived from pre-bubble valuation (peak occurred March 10, 2000, when the NASDAQ traded as high as 5132.52 and closed the day at 5048.62)

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Need to test stories

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Need to test stories
 - a resident of Cuba paid \$4,300 for a 25-year-old American car in 2000.

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Need to test stories
 - a resident of Cuba paid \$4,300 for a 25-year-old American car in 2000.
 - car was in deplorable condition, had windows that would not close and doors that wouldn't open in a normal fashion. The average wage in Cuba equals around \$10 a month. Was this a bubble?

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Need to test stories
 - a resident of Cuba paid \$4,300 for a 25-year-old American car in 2000.
 - car was in deplorable condition, had windows that would not close and doors that wouldn't open in a normal fashion. The average wage in Cuba equals around \$10 a month. Was this a bubble?
- Garber and others argue that fundamentals could explain high prices

Tulipmania

- Need to test stories
 - a resident of Cuba paid \$4,300 for a 25-year-old American car in 2000.
 - car was in deplorable condition, had windows that would not close and doors that wouldn't open in a normal fashion. The average wage in Cuba equals around \$10 a month. Was this a bubble?
- Garber and others argue that fundamentals could explain high prices
- It is often possible to rationalize high prices on a story of expectations about future earnings growth.

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Need to test stories
 - a resident of Cuba paid \$4,300 for a 25-year-old American car in 2000.
 - car was in deplorable condition, had windows that would not close and doors that wouldn't open in a normal fashion. The average wage in Cuba equals around \$10 a month. Was this a bubble?
- Garber and others argue that fundamentals could explain high prices
- It is often possible to rationalize high prices on a story of expectations about future earnings growth.
 - re-define earnings growth – define intangible capital

Tulipmania

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Need to test stories
 - a resident of Cuba paid \$4,300 for a 25-year-old American car in 2000.
 - car was in deplorable condition, had windows that would not close and doors that wouldn't open in a normal fashion. The average wage in Cuba equals around \$10 a month. Was this a bubble?
- Garber and others argue that fundamentals could explain high prices
- It is often possible to rationalize high prices on a story of expectations about future earnings growth.
 - re-define earnings growth – define intangible capital
- But one has to wonder why we rarely observe above-average earnings following such episodes?

What is a Rational Bubble?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Investors realize price is divorced from fundamentals, but believe that price rises will persist for some time, and that price growth will compensate for risk of collapse

What is a Rational Bubble?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Investors realize price is divorced from fundamentals, but believe that price rises will persist for some time, and that price growth will compensate for risk of collapse
 - they know that the bubble will collapse but believe they can get out before it does

What is a Rational Bubble?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Investors realize price is divorced from fundamentals, but believe that price rises will persist for some time, and that price growth will compensate for risk of collapse
 - they know that the bubble will collapse but believe they can get out before it does
- Irrational bubbles then involve unrealistic expectations about asset's future prospects

What is a Rational Bubble?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Investors realize price is divorced from fundamentals, but believe that price rises will persist for some time, and that price growth will compensate for risk of collapse
 - they know that the bubble will collapse but believe they can get out before it does
- Irrational bubbles then involve unrealistic expectations about asset's future prospects
 - fad, mania

What is a Rational Bubble?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Investors realize price is divorced from fundamentals, but believe that price rises will persist for some time, and that price growth will compensate for risk of collapse
 - they know that the bubble will collapse but believe they can get out before it does
- Irrational bubbles then involve unrealistic expectations about asset's future prospects
 - fad, mania
 - Irrational exuberance

What is a Rational Bubble?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Investors realize price is divorced from fundamentals, but believe that price rises will persist for some time, and that price growth will compensate for risk of collapse
 - they know that the bubble will collapse but believe they can get out before it does
- Irrational bubbles then involve unrealistic expectations about asset's future prospects
 - fad, mania
 - Irrational exuberance
- Let us consider a rational bubble

What is a Rational Bubble?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Investors realize price is divorced from fundamentals, but believe that price rises will persist for some time, and that price growth will compensate for risk of collapse
 - they know that the bubble will collapse but believe they can get out before it does
- Irrational bubbles then involve unrealistic expectations about asset's future prospects
 - fad, mania
 - Irrational exuberance
- Let us consider a rational bubble
 - think of a price of a fiat asset, so its value can, in principle, decrease forever

Simple Characterization

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Simple Characterization

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .
- At some time t_0 the price jumps to e_0

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Simple Characterization

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .
- At some time t_0 the price jumps to e_0
 - suppose agents expect $\Delta e_t = 1 + r$ in each future t .

Simple Characterization

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .
- At some time t_0 the price jumps to e_0
 - suppose agents expect $\Delta e_t = 1 + r$ in each future t .
 - i.e., $b_t = b_0(1 + r)^t$ for arbitrary b_0 . See figure 4

Simple Characterization

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .
- At some time t_0 the price jumps to e_0
 - suppose agents expect $\Delta e_t = 1 + r$ in each future t .
 - i.e., $b_t = b_0(1 + r)^t$ for arbitrary b_0 . See figure 4
 - Why are agents willing to pay increasing prices for the dollar?

Simple Characterization

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .
- At some time t_0 the price jumps to e_0
 - suppose agents expect $\Delta e_t = 1 + r$ in each future t .
 - i.e., $b_t = b_0(1 + r)^t$ for arbitrary b_0 . See figure 4
 - Why are agents willing to pay increasing prices for the dollar?
 - expected capital gains are self-fulfilling – this is a rational bubble, the capital gain on holding dollars compensates for the alternative returns.

Simple Characterization

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .
- At some time t_0 the price jumps to e_0
 - suppose agents expect $\Delta e_t = 1 + r$ in each future t .
 - i.e., $b_t = b_0(1 + r)^t$ for arbitrary b_0 . See figure 4
 - Why are agents willing to pay increasing prices for the dollar?
 - expected capital gains are self-fulfilling – this is a rational bubble, the capital gain on holding dollars compensates for the alternative returns.
 - Notice this requires the price to grow forever.

Simple Characterization

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Let e_t be the asset price; suppose fundamentals imply that $e_t = e^*$ for all t .
- At some time t_0 the price jumps to e_0
 - suppose agents expect $\Delta e_t = 1 + r$ in each future t .
 - i.e., $b_t = b_0(1 + r)^t$ for arbitrary b_0 . See figure 4
 - Why are agents willing to pay increasing prices for the dollar?
 - expected capital gains are self-fulfilling – this is a rational bubble, the capital gain on holding dollars compensates for the alternative returns.
 - Notice this requires the price to grow forever.
 - If everyone knew that at period $T + j$ that the bubble would burst ($e \rightarrow e^*$ or $b_t \rightarrow 0$) then no one would pay the bubble price at $T + j - 1$. The bubble unravels.

Simple Characterization

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

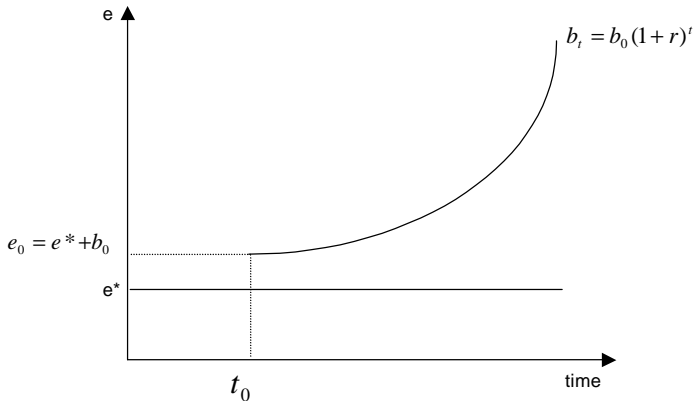


Figure: A bubble in the exchange rate

Stochastic Bubble

- Since prices cannot rise forever are bubbles ruled out?

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Stochastic Bubble

- Since prices cannot rise forever are bubbles ruled out?
 - no, as long as the date of price collapse is uncertain

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Stochastic Bubble

- Since prices cannot rise forever are bubbles ruled out?
 - no, as long as the date of price collapse is uncertain
- Suppose that in each period agents believe that the probability that the bubble will not burst is q . Then we have:

$$b_{t+1} = \begin{cases} \frac{(1+r)b_t}{q} + \varepsilon_{t+1} & \text{with probability } q \\ \varepsilon_{t+1} & \text{with probability } 1 - q \end{cases} \quad (1)$$

Stochastic Bubble

- Since prices cannot rise forever are bubbles ruled out?
 - no, as long as the date of price collapse is uncertain
- Suppose that in each period agents believe that the probability that the bubble will not burst is q . Then we have:

$$b_{t+1} = \begin{cases} \frac{(1+r)b_t}{q} + \varepsilon_{t+1} & \text{with probability } q \\ \varepsilon_{t+1} & \text{with probability } 1 - q \end{cases} \quad (1)$$

- where ε_{t+1} is a white noise error, with mean 0.

Stochastic Bubble

- Since prices cannot rise forever are bubbles ruled out?
 - no, as long as the date of price collapse is uncertain
- Suppose that in each period agents believe that the probability that the bubble will not burst is q . Then we have:

$$b_{t+1} = \begin{cases} \frac{(1+r)b_t}{q} + \varepsilon_{t+1} & \text{with probability } q \\ \varepsilon_{t+1} & \text{with probability } 1 - q \end{cases} \quad (1)$$

- where ε_{t+1} is a white noise error, with mean 0.
- If the bubble follows this path it is rational.

Stochastic Bubble

- Since prices cannot rise forever are bubbles ruled out?
 - no, as long as the date of price collapse is uncertain
- Suppose that in each period agents believe that the probability that the bubble will not burst is q . Then we have:

$$b_{t+1} = \begin{cases} \frac{(1+r)b_t}{q} + \varepsilon_{t+1} & \text{with probability } q \\ \varepsilon_{t+1} & \text{with probability } 1 - q \end{cases} \quad (1)$$

- where ε_{t+1} is a white noise error, with mean 0.
- If the bubble follows this path it is rational.
 - notice that the expected value of the bubble in period $T + 1$ is exactly b_{t+1} .

Stochastic Bubble

- Since prices cannot rise forever are bubbles ruled out?
 - no, as long as the date of price collapse is uncertain
- Suppose that in each period agents believe that the probability that the bubble will not burst is q . Then we have:

$$b_{t+1} = \begin{cases} \frac{(1+r)b_t}{q} + \varepsilon_{t+1} & \text{with probability } q \\ \varepsilon_{t+1} & \text{with probability } 1 - q \end{cases} \quad (1)$$

- where ε_{t+1} is a white noise error, with mean 0.
- If the bubble follows this path it is rational.
 - notice that the expected value of the bubble in period $T + 1$ is exactly b_{t+1} .
 - To see this, note that $E_t[b_{t+1}] = q \frac{(1+r)b_t}{q} + (1 - q)(0) = (1 + r)b_t$, which is our initial expression for the bubble path.

Stochastic Bubble

- Notice that the stochastic bubble grows faster than under certainty, because investors must be compensated for the risk of the bubble bursting.

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Stochastic Bubble

- Notice that the stochastic bubble grows faster than under certainty, because investors must be compensated for the risk of the bubble bursting.

- $$\frac{(1+r)b_t}{q} > (1+r)b_t$$

Stochastic Bubble

- Notice that the stochastic bubble grows faster than under certainty, because investors must be compensated for the risk of the bubble bursting.

- $\frac{(1+r)b_t}{q} > (1+r)b_t$

- From rational bubble we can back out the market's expectation of it bursting.

Stochastic Bubble

- Notice that the stochastic bubble grows faster than under certainty, because investors must be compensated for the risk of the bubble bursting.

- $\frac{(1+r)b_t}{q} > (1+r)b_t$

- From rational bubble we can back out the market's expectation of it bursting.
 - At any t you know the actual price and the interest rate, and if you know e^* you can calculate $b_t = e_t - e^*$

Stochastic Bubble

- Notice that the stochastic bubble grows faster than under certainty, because investors must be compensated for the risk of the bubble bursting.
 - $\frac{(1+r)b_t}{q} > (1+r)b_t$
- From rational bubble we can back out the market's expectation of it bursting.
 - At any t you know the actual price and the interest rate, and if you know e^* you can calculate $b_t = e_t - e^*$
- if the bubble has *not* burst yet then $b_{t+1} = \frac{(1+r)b_t}{q}$ so that

$$q = \frac{(1+r)b_t}{b_{t+1}}. \quad (2)$$

Stochastic Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Notice that the stochastic bubble grows faster than under certainty, because investors must be compensated for the risk of the bubble bursting.
 - $\frac{(1+r)b_t}{q} > (1+r)b_t$
- From rational bubble we can back out the market's expectation of it bursting.
 - At any t you know the actual price and the interest rate, and if you know e^* you can calculate $b_t = e_t - e^*$
- if the bubble has *not* burst yet then $b_{t+1} = \frac{(1+r)b_t}{q}$ so that

$$q = \frac{(1+r)b_t}{b_{t+1}}. \quad (2)$$

- This probability can be then compared to the amount of time the bubble has been growing.

Stochastic Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Notice that the stochastic bubble grows faster than under certainty, because investors must be compensated for the risk of the bubble bursting.
 - $\frac{(1+r)b_t}{q} > (1+r)b_t$
- From rational bubble we can back out the market's expectation of it bursting.
 - At any t you know the actual price and the interest rate, and if you know e^* you can calculate $b_t = e_t - e^*$
- if the bubble has *not* burst yet then $b_{t+1} = \frac{(1+r)b_t}{q}$ so that

$$q = \frac{(1+r)b_t}{b_{t+1}}. \quad (2)$$

- This probability can be then compared to the amount of time the bubble has been growing.
 - This notion of a rational bubble is used frequently in analysis of asset markets.

Stochastic Rational Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Fact that bubble has to grow at an expected rate of r allows one to eliminate many potential rational bubbles.

Stochastic Rational Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Fact that bubble has to grow at an expected rate of r allows one to eliminate many potential rational bubbles.
 - commodities with close substitutes puts limits

Stochastic Rational Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Fact that bubble has to grow at an expected rate of r allows one to eliminate many potential rational bubbles.
 - commodities with close substitutes puts limits
 - a bubble on a non-zero supply asset cannot arise if the r exceeds the growth rate of the economy, since the bubble would outgrow the aggregate wealth in the economy.

Stochastic Rational Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Fact that bubble has to grow at an expected rate of r allows one to eliminate many potential rational bubbles.
 - commodities with close substitutes puts limits
 - a bubble on a non-zero supply asset cannot arise if the r exceeds the growth rate of the economy, since the bubble would outgrow the aggregate wealth in the economy.
 - Hence, bubbles can only exist in a world in which the $r \leq$ the growth rate of the economy.

Stochastic Rational Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Fact that bubble has to grow at an expected rate of r allows one to eliminate many potential rational bubbles.
 - commodities with close substitutes puts limits
 - a bubble on a non-zero supply asset cannot arise if the r exceeds the growth rate of the economy, since the bubble would outgrow the aggregate wealth in the economy.
 - Hence, bubbles can only exist in a world in which the $r \leq$ the growth rate of the economy.
- In a rational bubble setting an investor only holds a bubble asset if the bubble grows in expectations ad infinitum.

Asymmetric Information Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- With asymmetric information bubbles can occur

Asymmetric Information Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- With asymmetric information bubbles can occur
- Key point is common knowledge

Asymmetric Information Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- With asymmetric information bubbles can occur
- Key point is common knowledge
 - it might be the case that everybody knows the price exceeds the value of any possible dividend stream, but it is not the case that everybody knows that all the other investors also know this fact.

Asymmetric Information Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- With asymmetric information bubbles can occur
- Key point is common knowledge
 - it might be the case that everybody knows the price exceeds the value of any possible dividend stream, but it is not the case that everybody knows that all the other investors also know this fact.
 - Each trader tries to forecast when other rational traders will go against the bubble. If I attack too early I lose profits, if I attack late, I lose. This is important if people learn *sequentially*.

Asymmetric Information Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- With asymmetric information bubbles can occur
- Key point is common knowledge
 - it might be the case that everybody knows the price exceeds the value of any possible dividend stream, but it is not the case that everybody knows that all the other investors also know this fact.
 - Each trader tries to forecast when other rational traders will go against the bubble. If I attack too early I lose profits, if I attack late, I lose. This is important if people learn *sequentially*.
 - Important, since one short may not be able to prick bubble. So wait till I know enough people know, that enough people know it is a bubble

Limited Arbitrage

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Arbitrage kills bubbles, but if short sellers face liquidity constraints bubbles can occur

Limited Arbitrage

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Arbitrage kills bubbles, but if short sellers face liquidity constraints bubbles can occur
 - For example, in a world with delegated portfolio management, fund managers are often concerned about short-run price movements, because temporary losses instigate fund outflows

Limited Arbitrage

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Arbitrage kills bubbles, but if short sellers face liquidity constraints bubbles can occur
 - For example, in a world with delegated portfolio management, fund managers are often concerned about short-run price movements, because temporary losses instigate fund outflows
 - Arbitrager with limited funds may be forced to unwind the position prematurely.

Limited Arbitrage

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Arbitrage kills bubbles, but if short sellers face liquidity constraints bubbles can occur
 - For example, in a world with delegated portfolio management, fund managers are often concerned about short-run price movements, because temporary losses instigate fund outflows
 - Arbitrager with limited funds may be forced to unwind the position prematurely.
 - Can happen if there are noise traders who move prices away from fundamentals temporarily

Limited Arbitrage

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Arbitrage kills bubbles, but if short sellers face liquidity constraints bubbles can occur
 - For example, in a world with delegated portfolio management, fund managers are often concerned about short-run price movements, because temporary losses instigate fund outflows
 - Arbitrager with limited funds may be forced to unwind the position prematurely.
 - Can happen if there are noise traders who move prices away from fundamentals temporarily
 - If value of portfolio falls arbitrager may be unable to finance a position, and unwinds the short sale

Limited Arbitrage

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- Arbitrage kills bubbles, but if short sellers face liquidity constraints bubbles can occur
 - For example, in a world with delegated portfolio management, fund managers are often concerned about short-run price movements, because temporary losses instigate fund outflows
 - Arbitrager with limited funds may be forced to unwind the position prematurely.
 - Can happen if there are noise traders who move prices away from fundamentals temporarily
 - If value of portfolio falls arbitrager may be unable to finance a position, and unwinds the short sale
 - profitable trades are not exploited

Limited Arbitrage: Example

- Consider 2 futures contracts to deliver German bonds worth E250,000 at time T .

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Limited Arbitrage: Example

- Consider 2 futures contracts to deliver German bonds worth E250,000 at time T .
 - price in Frankfurt = E245,000, in London = E240,000.

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Limited Arbitrage: Example

- Consider 2 futures contracts to deliver German bonds worth E250,000 at time T .
 - price in Frankfurt = E245,000, in London = E240,000.
 - arbitrageur goes long London short Frankfurt. At time T he is perfectly hedged. In meantime he puts up margin: say, E3500 in Frankfurt and E3000 in London.

Limited Arbitrage: Example

- Consider 2 futures contracts to deliver German bonds worth E250,000 at time T .
 - price in Frankfurt = E245,000, in London = E240,000.
 - arbitrageur goes long London short Frankfurt. At time T he is perfectly hedged. In meantime he puts up margin: say, E3500 in Frankfurt and E3000 in London.
 - If $P_t = E242,500$ at $t < T$, close both positions, pocket E5,000 which is big return on cash upfront of E6500.

Limited Arbitrage: Example

- Consider 2 futures contracts to deliver German bonds worth E250,000 at time T .
 - price in Frankfurt = E245,000, in London = E240,000.
 - arbitrageur goes long London short Frankfurt. At time T he is perfectly hedged. In meantime he puts up margin: say, E3500 in Frankfurt and E3000 in London.
 - If $P_t = E242,500$ at $t < T$, close both positions, pocket E5,000 which is big return on cash upfront of E6500.
 - What if prices widen at $t < T$? What if Frankfurt price \nearrow E245,000? More margin required. Presumably E5000.

Limited Arbitrage: Example

- Consider 2 futures contracts to deliver German bonds worth E250,000 at time T .
 - price in Frankfurt = E245,000, in London = E240,000.
 - arbitrageur goes long London short Frankfurt. At time T he is perfectly hedged. In meantime he puts up margin: say, E3500 in Frankfurt and E3000 in London.
 - If $P_t = E242,500$ at $t < T$, close both positions, pocket E5,000 which is big return on cash upfront of E6500.
 - What if prices widen at $t < T$? What if Frankfurt price \nearrow E245,000? More margin required. Presumably E5000.
 - In the short run he needs to come up with more funds, and the value of his portfolio has deteriorated.

Limited Arbitrage: Example

- Consider 2 futures contracts to deliver German bonds worth E250,000 at time T .
 - price in Frankfurt = E245,000, in London = E240,000.
 - arbitrageur goes long London short Frankfurt. At time T he is perfectly hedged. In meantime he puts up margin: say, E3500 in Frankfurt and E3000 in London.
 - If $P_t = E242,500$ at $t < T$, close both positions, pocket E5,000 which is big return on cash upfront of E6500.
 - What if prices widen at $t < T$? What if Frankfurt price \nearrow E245,000? More margin required. Presumably E5000.
 - In the short run he needs to come up with more funds, and the value of his portfolio has deteriorated.
- Now what matters is *how deep are the arbitrageurs' pockets?* Performance-based evaluation could lead to bailout of the fund at the moment when returns are highest!

Limited Arbitrage: Evidence

- Evidence that hedge funds rode dotcom bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Limited Arbitrage: Evidence

- Evidence that hedge funds rode dotcom bubble
 - when the Nasdaq peaked in March 2000, hedge funds \sim 31% of stock portfolio to tech stocks. For comparison, tech stocks \sim 21% in the market portfolio at that time.

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

Limited Arbitrage: Evidence

- Evidence that hedge funds rode dotcom bubble
 - when the Nasdaq peaked in March 2000, hedge funds \sim 31% of stock portfolio to tech stocks. For comparison, tech stocks \sim 21% in the market portfolio at that time.
 - When prices were rising the hedge funds were over-weighted in techs, they reduced as the price fell.

Limited Arbitrage: Evidence

- Evidence that hedge funds rode dotcom bubble
 - when the Nasdaq peaked in March 2000, hedge funds \sim 31% of stock portfolio to tech stocks. For comparison, tech stocks \sim 21% in the market portfolio at that time.
 - When prices were rising the hedge funds were over-weighted in techs, they reduced as the price fell.
 - Hoares Bank was profitably riding the South Sea bubble in 1719-1720, despite giving numerous indications that it believed the stock to be overvalued.

Limited Arbitrage: Evidence

- Evidence that hedge funds rode dotcom bubble
 - when the Nasdaq peaked in March 2000, hedge funds ~ 31% of stock portfolio to tech stocks. For comparison, tech stocks ~ 21% in the market portfolio at that time.
 - When prices were rising the hedge funds were over-weighted in techs, they reduced as the price fell.
 - Hoares Bank was profitably riding the South Sea bubble in 1719-1720, despite giving numerous indications that it believed the stock to be overvalued.
 - Many other investors, including Isaac Newton, also tried to ride the South Sea bubble but with less success.

Limited Arbitrage: Evidence

- Evidence that hedge funds rode dotcom bubble
 - when the Nasdaq peaked in March 2000, hedge funds \sim 31% of stock portfolio to tech stocks. For comparison, tech stocks \sim 21% in the market portfolio at that time.
 - When prices were rising the hedge funds were over-weighted in techs, they reduced as the price fell.
 - Hoares Bank was profitably riding the South Sea bubble in 1719-1720, despite giving numerous indications that it believed the stock to be overvalued.
 - Many other investors, including Isaac Newton, also tried to ride the South Sea bubble but with less success.
 - Frustrated with his trading experience, Isaac Newton concluded “I can calculate the motions of the heavenly bodies, but not the madness of people.”

Limited Arbitrage: Evidence

- Evidence that hedge funds rode dotcom bubble
 - when the Nasdaq peaked in March 2000, hedge funds \sim 31% of stock portfolio to tech stocks. For comparison, tech stocks \sim 21% in the market portfolio at that time.
 - When prices were rising the hedge funds were over-weighted in techs, they reduced as the price fell.
 - Hoares Bank was profitably riding the South Sea bubble in 1719-1720, despite giving numerous indications that it believed the stock to be overvalued.
 - Many other investors, including Isaac Newton, also tried to ride the South Sea bubble but with less success.
 - Frustrated with his trading experience, Isaac Newton concluded "I can calculate the motions of the heavenly bodies, but not the madness of people."
- Lack of short selling due to asymmetric information leads to bubbles and misallocation of resources

Hedge Funds and Tech Bubble

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

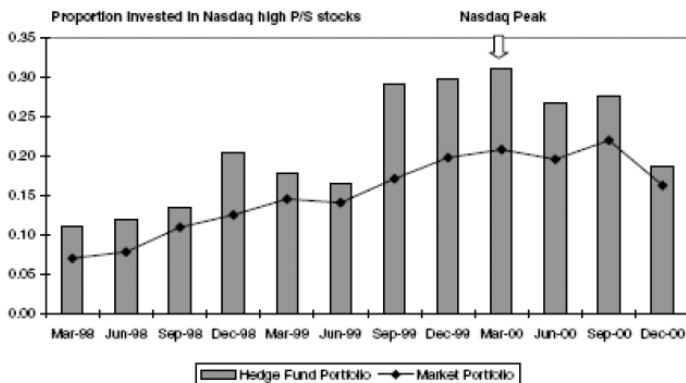


Figure 2. Weight of Nasdaq technology stocks (high P/S) in aggregate hedge fund portfolio versus weight in market portfolio. At the end of each quarter, we compute the weight, in terms of market value, of high P/S quintile Nasdaq stocks in the overall stock portfolio of hedge funds, given their reported holdings on form 13F. For comparison, we also report the value-weight of high P/S stocks in the market portfolio (all stocks on CRSP).

South Sea Bubble and Tech Stocks

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

	Stock	Price increase*	Peak-to- trough**	St.dev. of daily returns
<i>South Sea bubble</i>	South Sea Company	843.0%	-88.0%	6.3%
	East India Company	45.0%	-68.0%	12.8%
	Bank of England	51.0%	-54.0%	15.8%
<i>Dotcom mania</i>	Amazon	188.0%	-79.9%	5.9%
	Cisco	220.0%	-76.5%	3.4%
	Microsoft	86.0%	-65.0%	3.0%

Note: * from minimum during 12 months prior to peak

** 12 months subsequent to peak

South Sea Stock and Hoare's Trading

Lecture Note

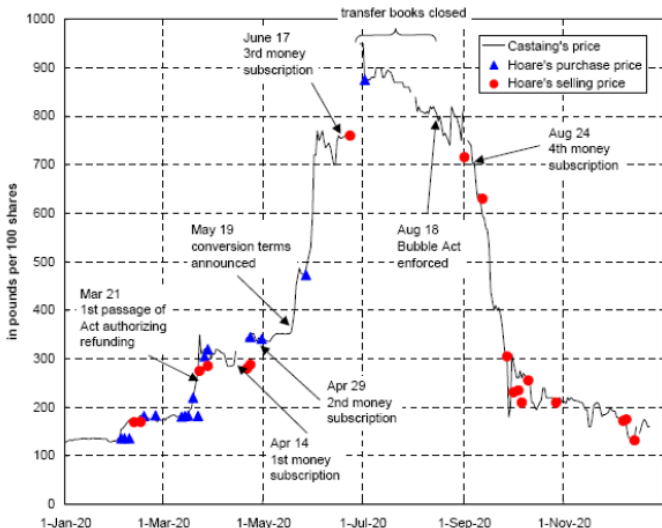
Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary



Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- The key point about bubbles is that they have violent collapses

Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- The key point about bubbles is that they have violent collapses
- They can lead to distortions in resource allocation

Bubbles

Lecture Note

Ickes

Bubbles

Rational
Bubbles

Asymmetric
Information
Bubbles

Summary

- The key point about bubbles is that they have violent collapses
- They can lead to distortions in resource allocation
- They may be associated with financial collapses