# Cognitive biases and Asset Bubbles

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Talk prepared for Society of Technical Analysts NZ (STANZ)

April 13, 2021

# Eugene Fama: Efficient markets theory

- The current price of a stock should
  - reflect the risk adjusted discounted value of expected future dividends to be paid on it;
  - subsume all the relevant information and should not change unless something fundamental about the market changes;
  - track the **fundamental value** closely and that it should be difficult to "beat the market" by buying and selling such shares.
- If all traders are **perfectly rational** and **equally well-informed** about the market conditions, then they should all price the stock in a similar way.

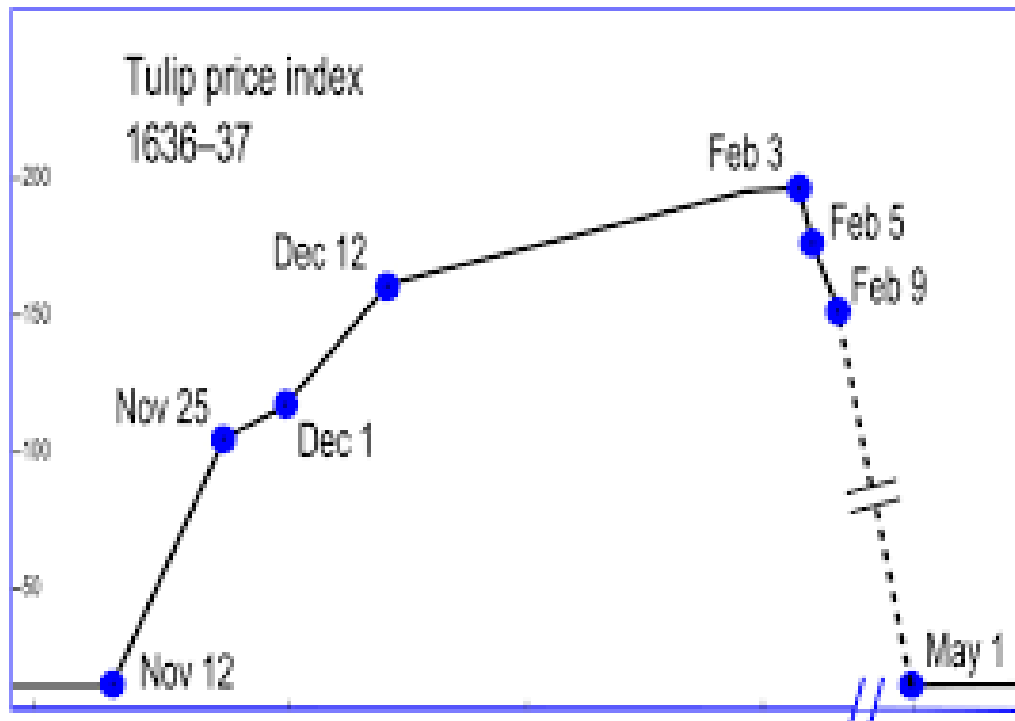US Housing bubble (and crash) circa 1998-2007

South Sea Company bubble
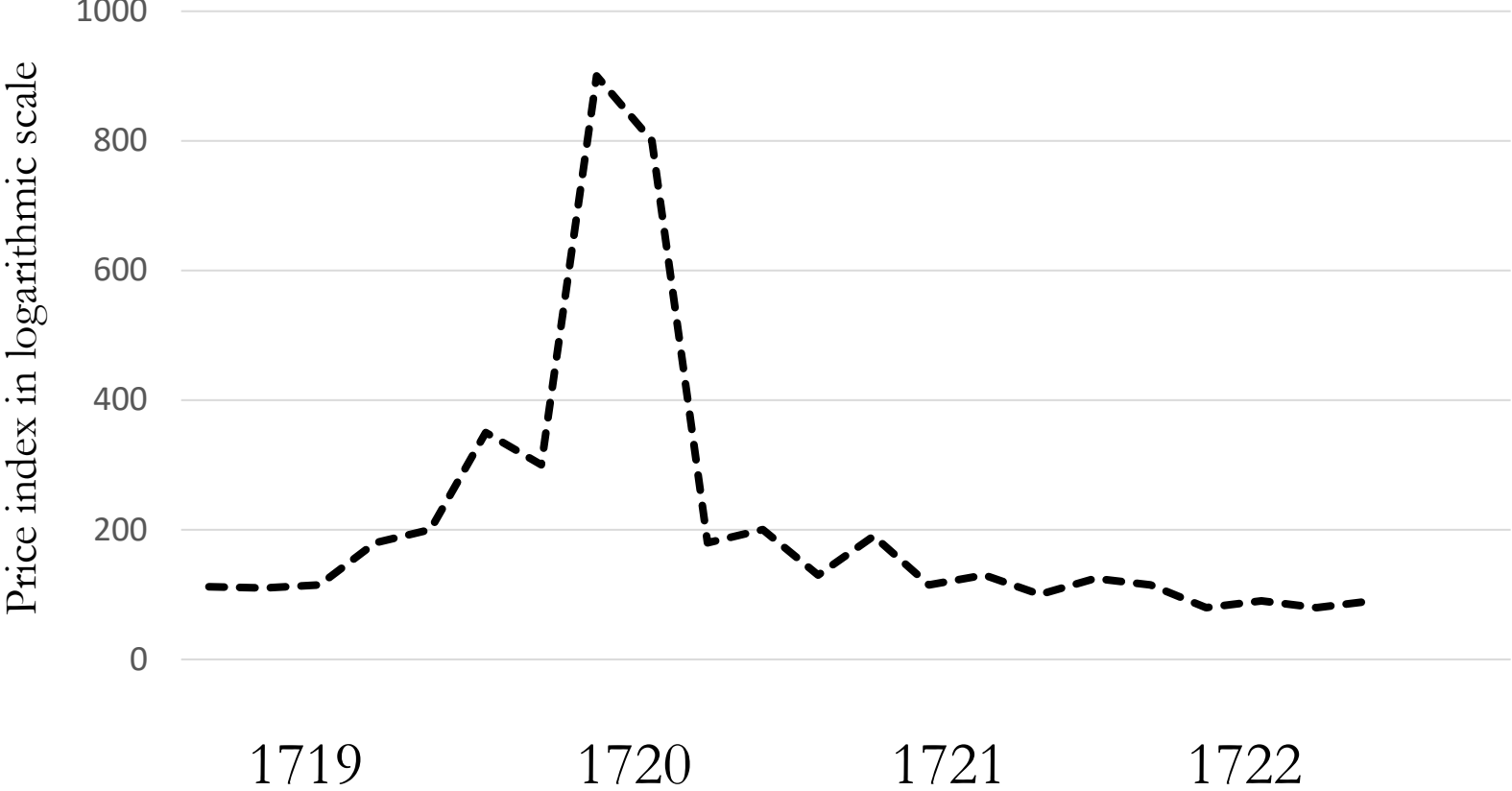
# Tulip mania in Holland 1636-37

# Tech stock bubble, circa 2000

# Smith, Suchanek and Williams (1988): Asset bubbles in laboratory markets

- Suppose, you own a financial asset in the form of shares of a company.

- A "share" indicates one unit of this financial asset.

- Further, suppose that these shares last for a finite amount of time after which point, they become value-less.

- *One-quarter chance that this dividend payment will take one of four values: $0, $0.08, $0.28 and $0.60. This implies that in any period the expected dividend is (1/4)X(0 + 0.08 + 0.28 = 0.60) = $0.24.*

- So, on average, you would expect to earn $0.24 in dividend payment for each share held.

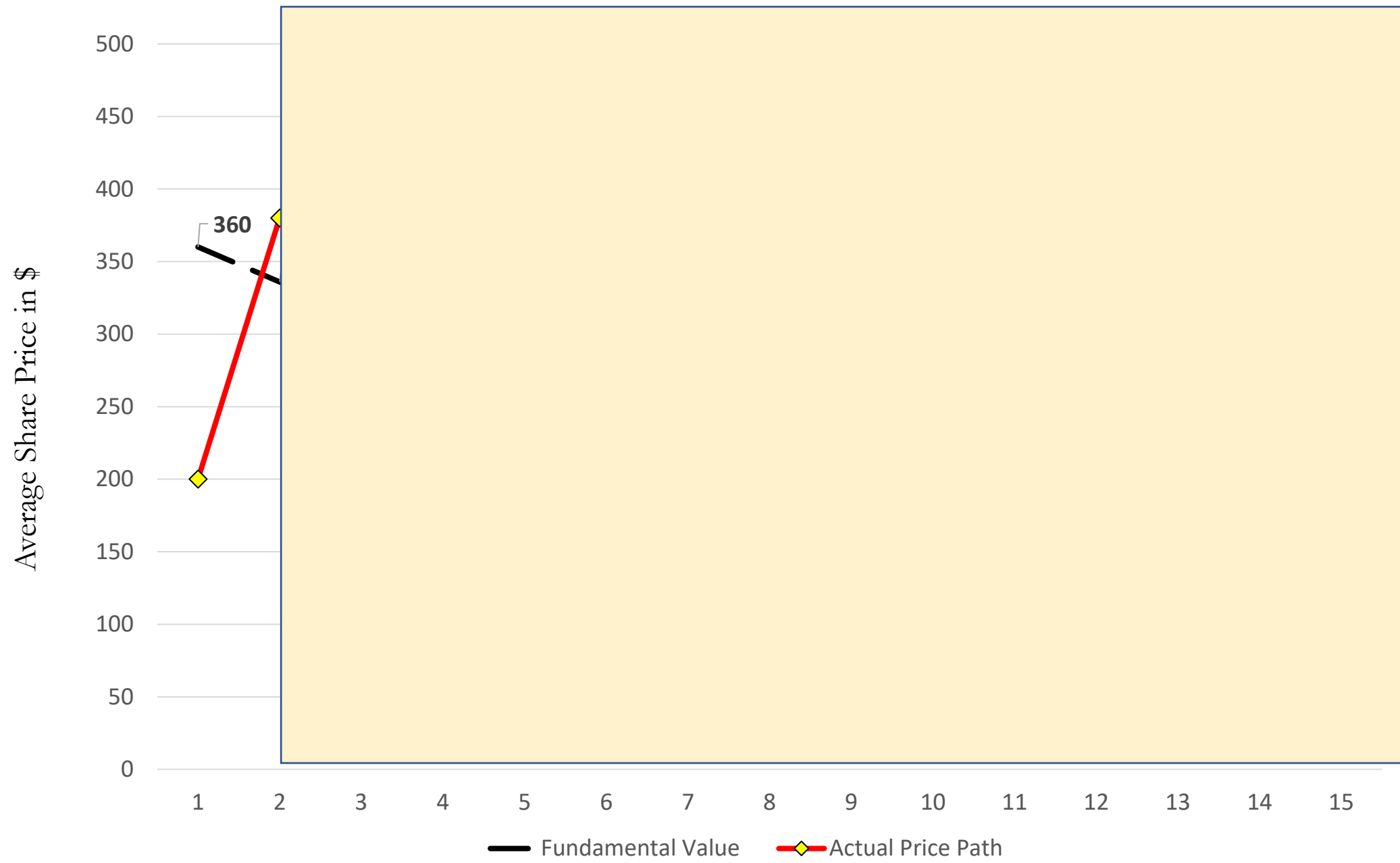# Smith, Suchanek and Williams (1988): Asset bubbles in laboratory markets

- Traders interact for 15 periods.
- Endowed with differential amounts of cash and shares to start with
  - Does not matter whether endowments are identical or not.
- At the start of the experiment, each trader receives some cash money and some shares.
- The cash held earns interest, but it can also be used to buy shares.
- ***Since, each share earns an expected dividend of $0.24 per period, expected dividend over 15 periods, is ($0.024)X(1)5 = $3.60.***
  - For the sake of simplicity, no discounting of future payoffs; does not make any difference to the underlying intuition of this exercise.
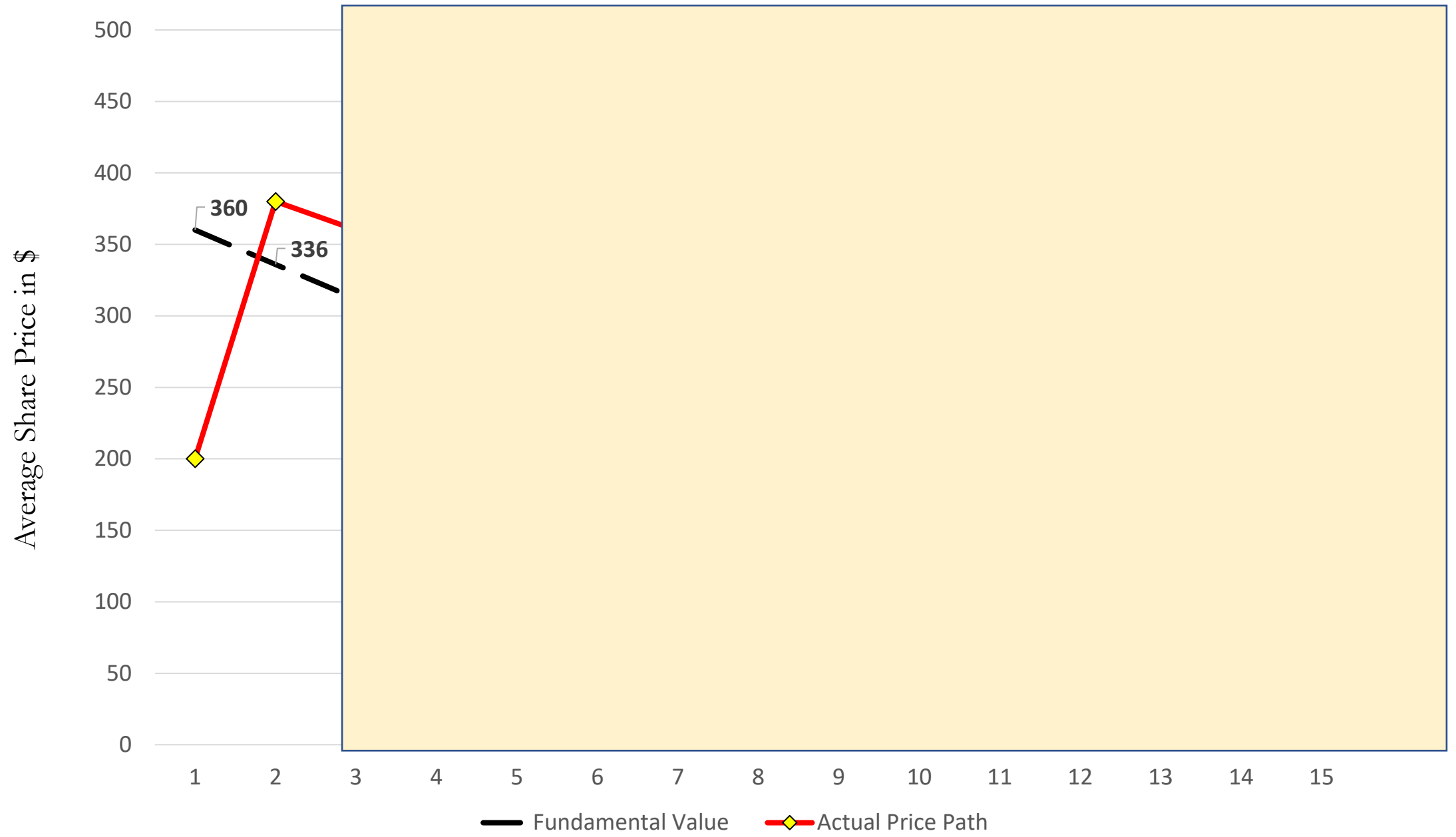
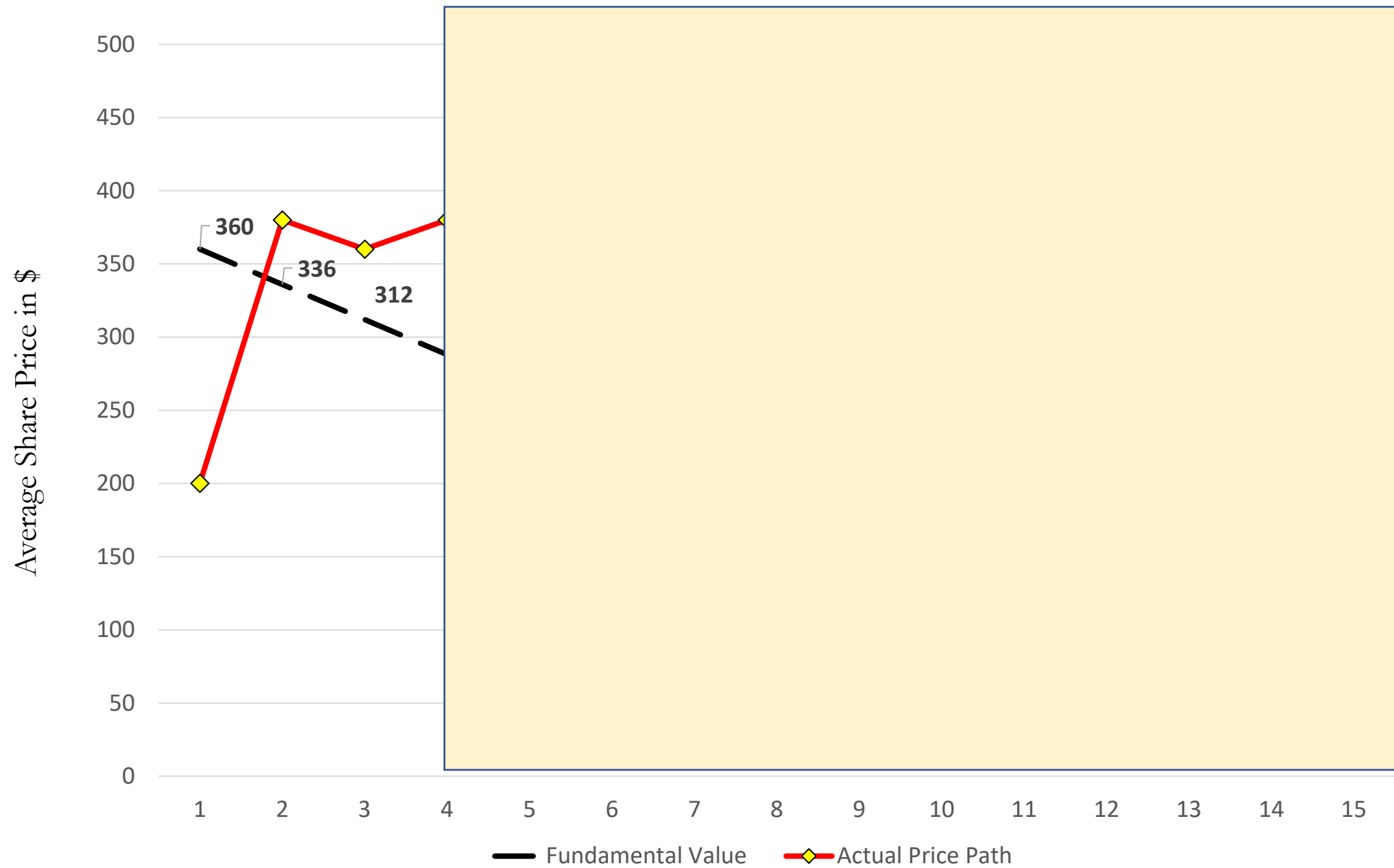# Smith, Suchanek and Williams (1988): Asset bubbles in laboratory markets

- As opposed to real-life markets, the variables within the experiment are controlled tightly.

- All experimental parameters are ***common knowledge.*** Participants know what the expected dividends, interest rates, number of rounds etc. are;

- This is different from real markets where not all participants are aware of relevant opportunities and/or opportunity costs.
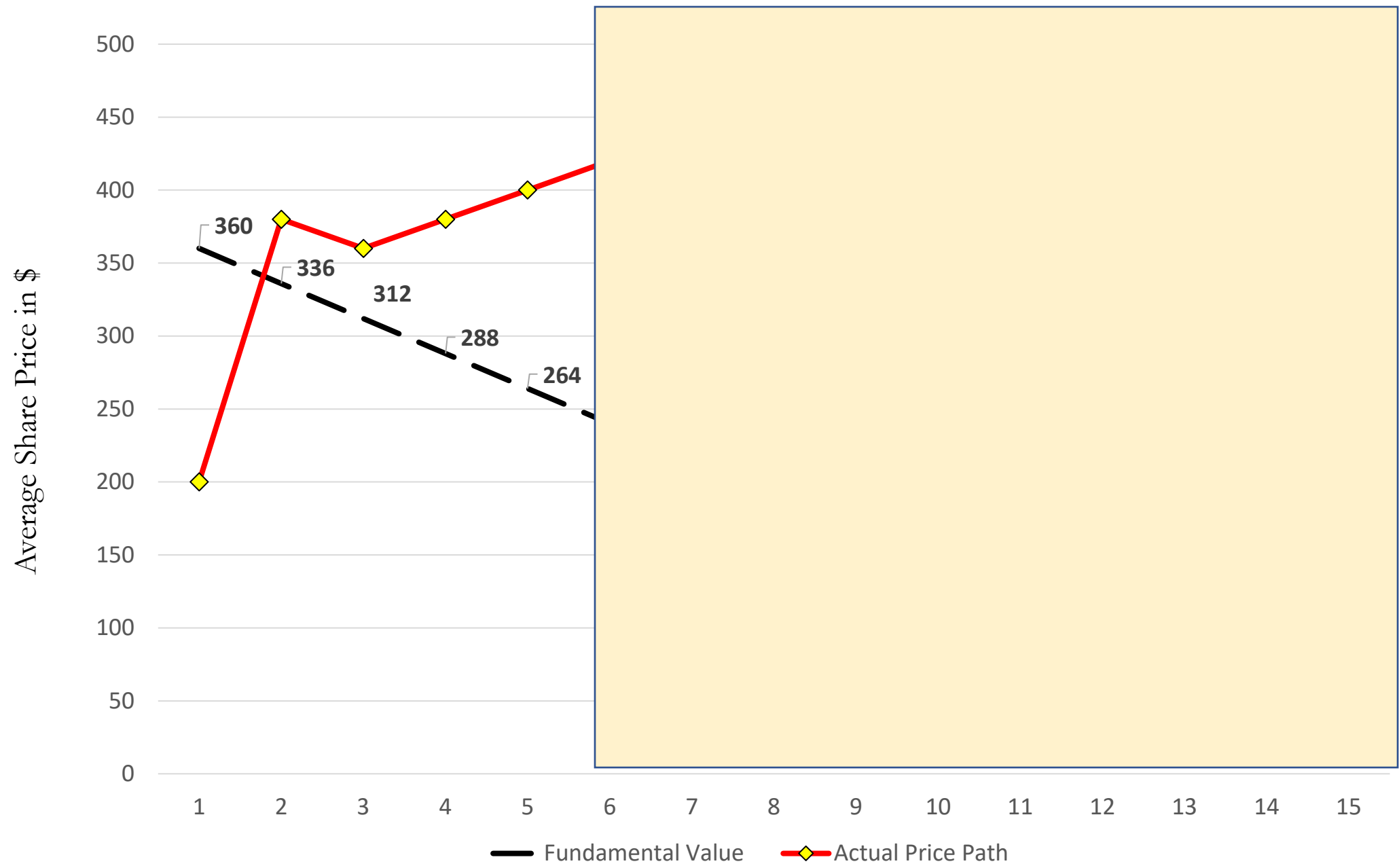
# Smith, Suchanek and Williams (1988): Asset bubbles in laboratory markets

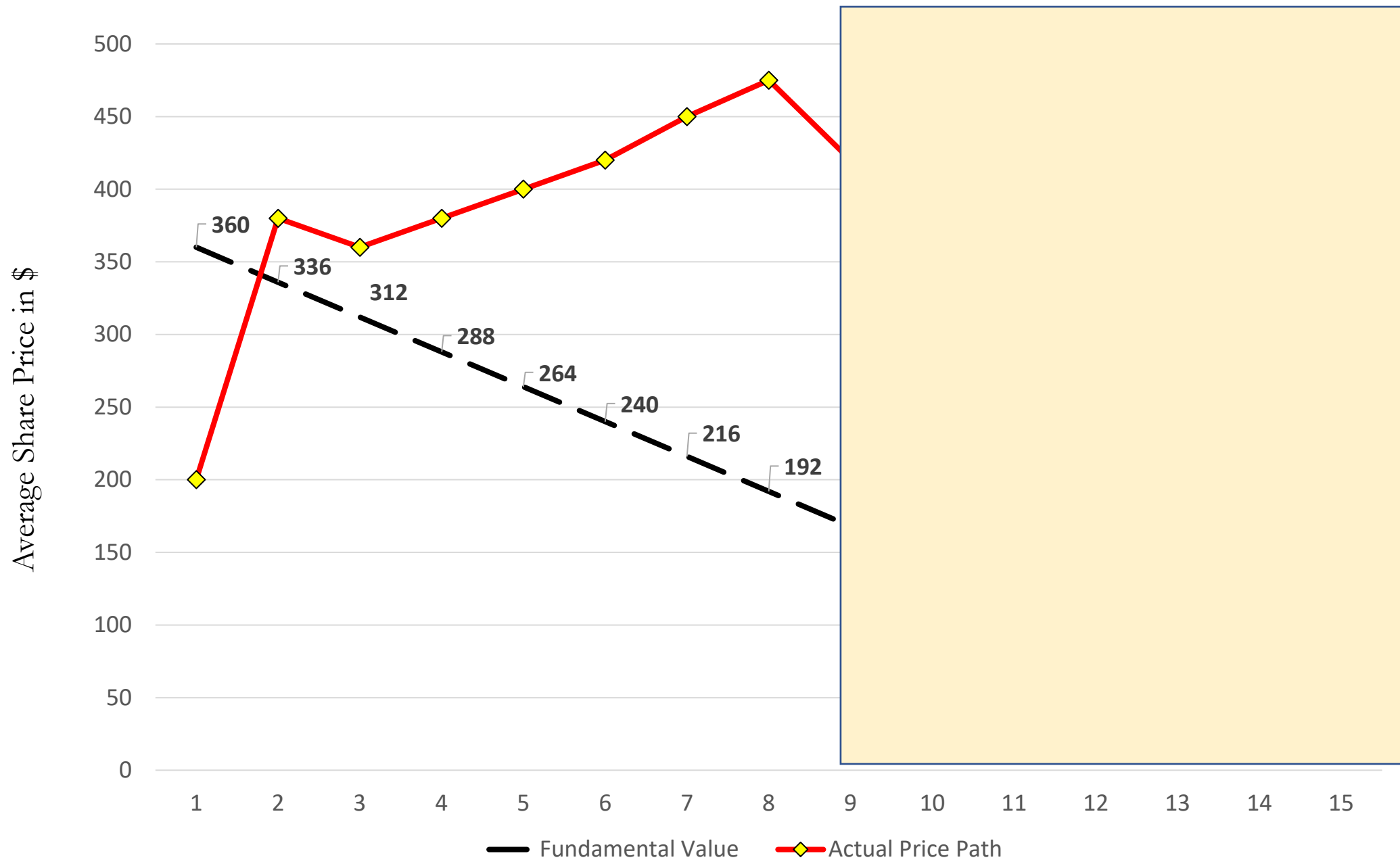- Second, given this experimental control and common knowledge of parameters among participants, the fundamental value of a share ($3.60 over 15 rounds) should be commonly understood.

- So, at the beginning of the session, the expected value of a share is $3.60;

- With (say) 10 periods left, the expected value of the share is $2.40; with 2 periods left, the share is worth only $0.48 and so on.

- Possibility of capital gains

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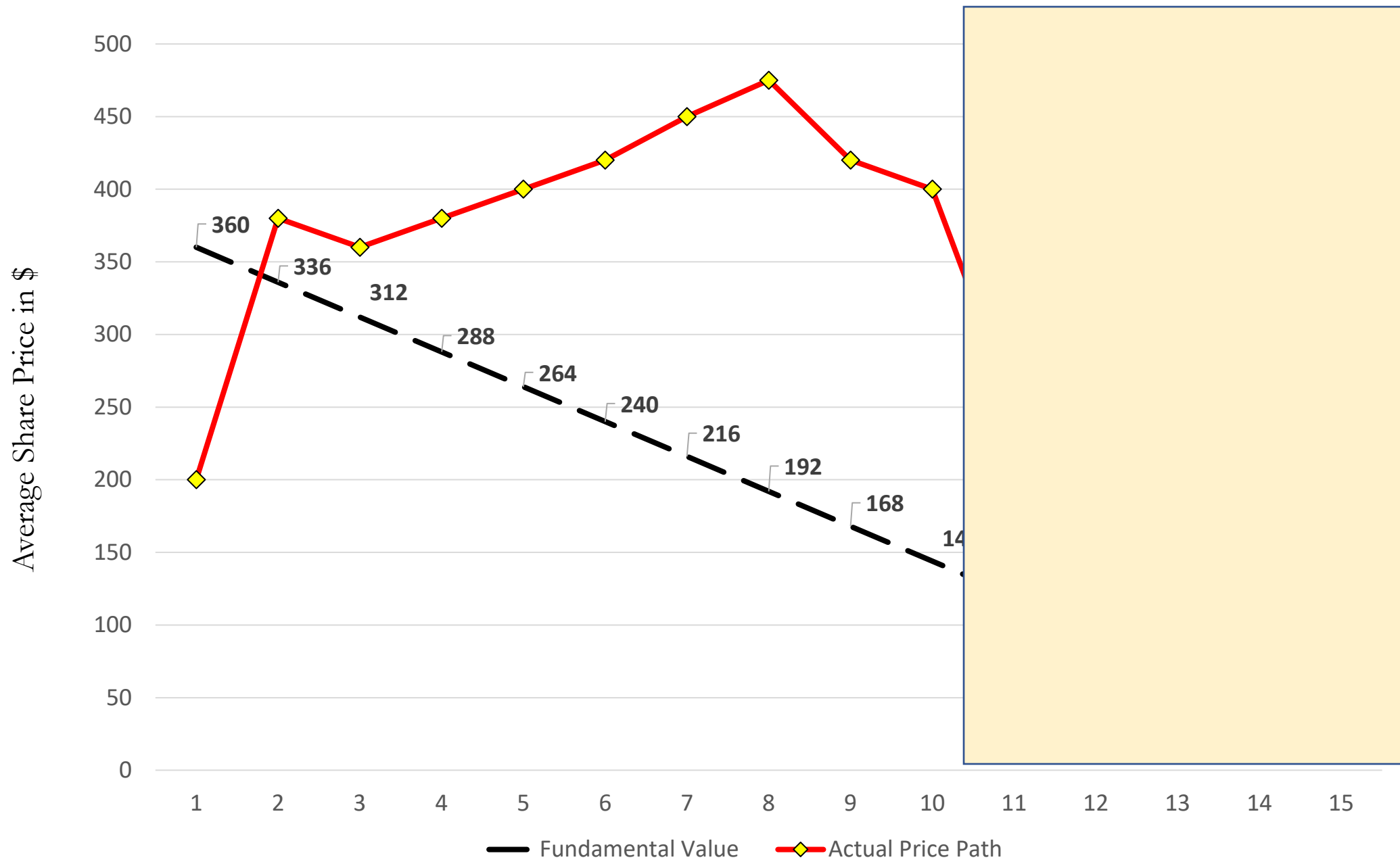STANZ Talk, April 13, 2021                                                                                                    15
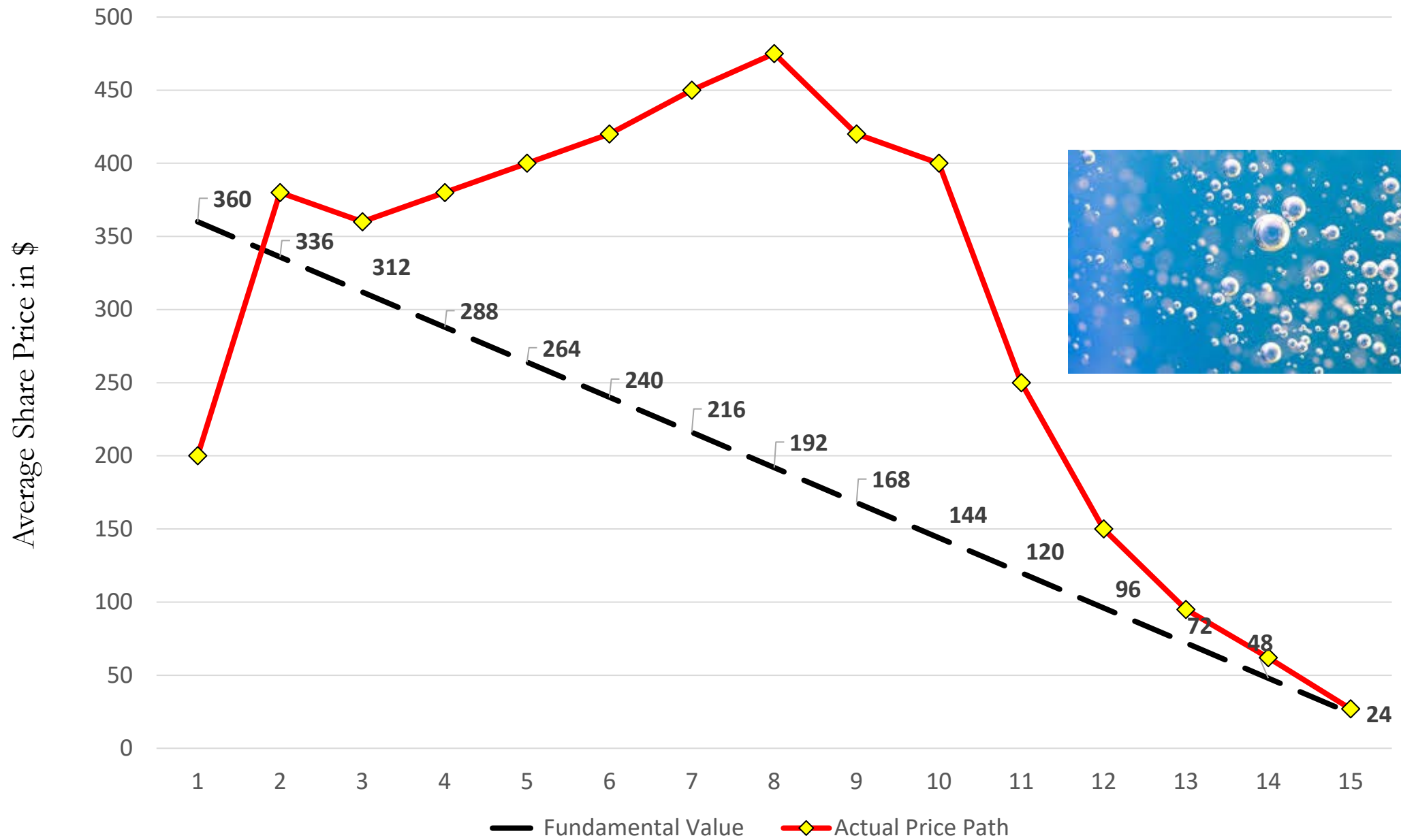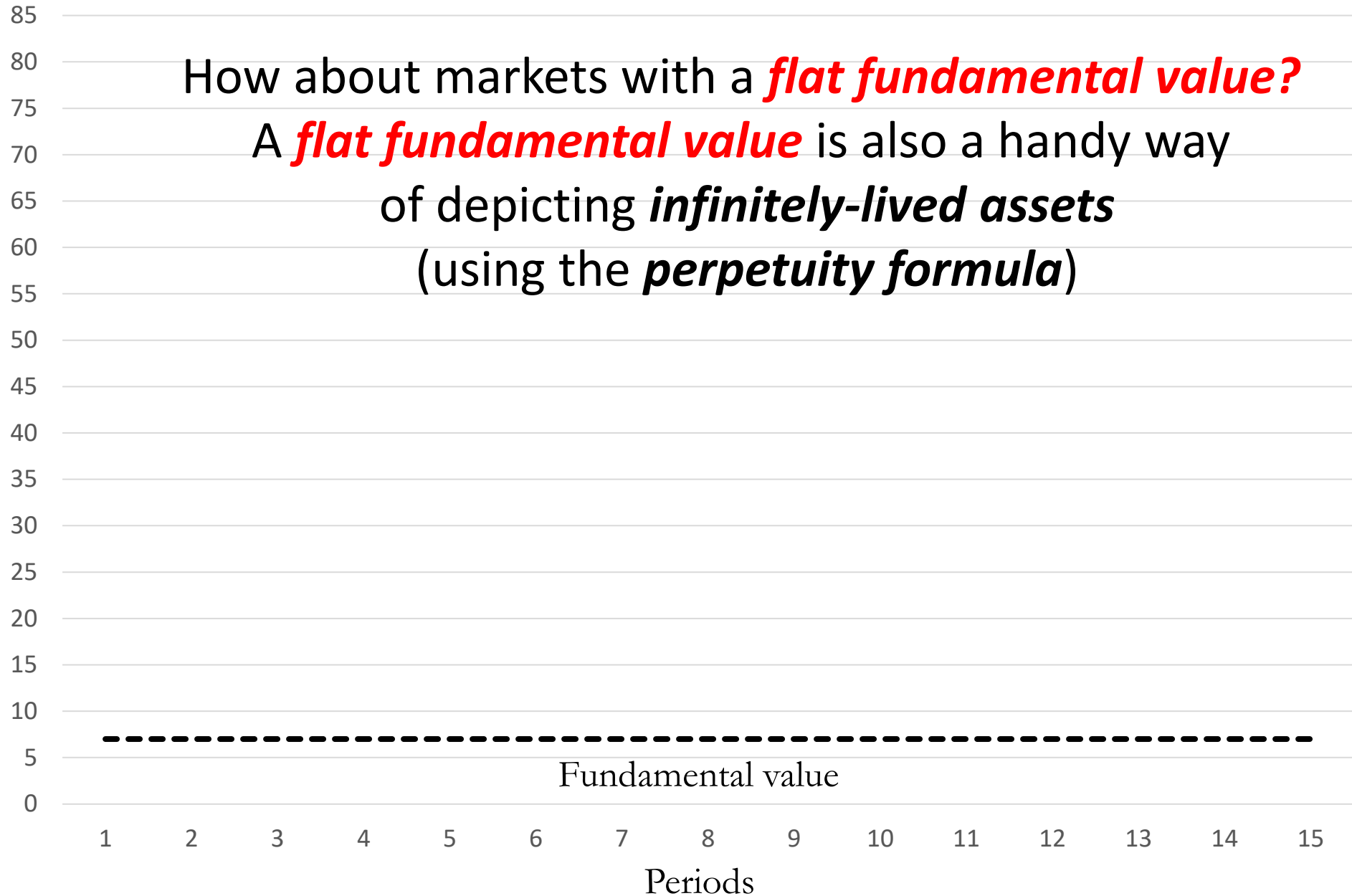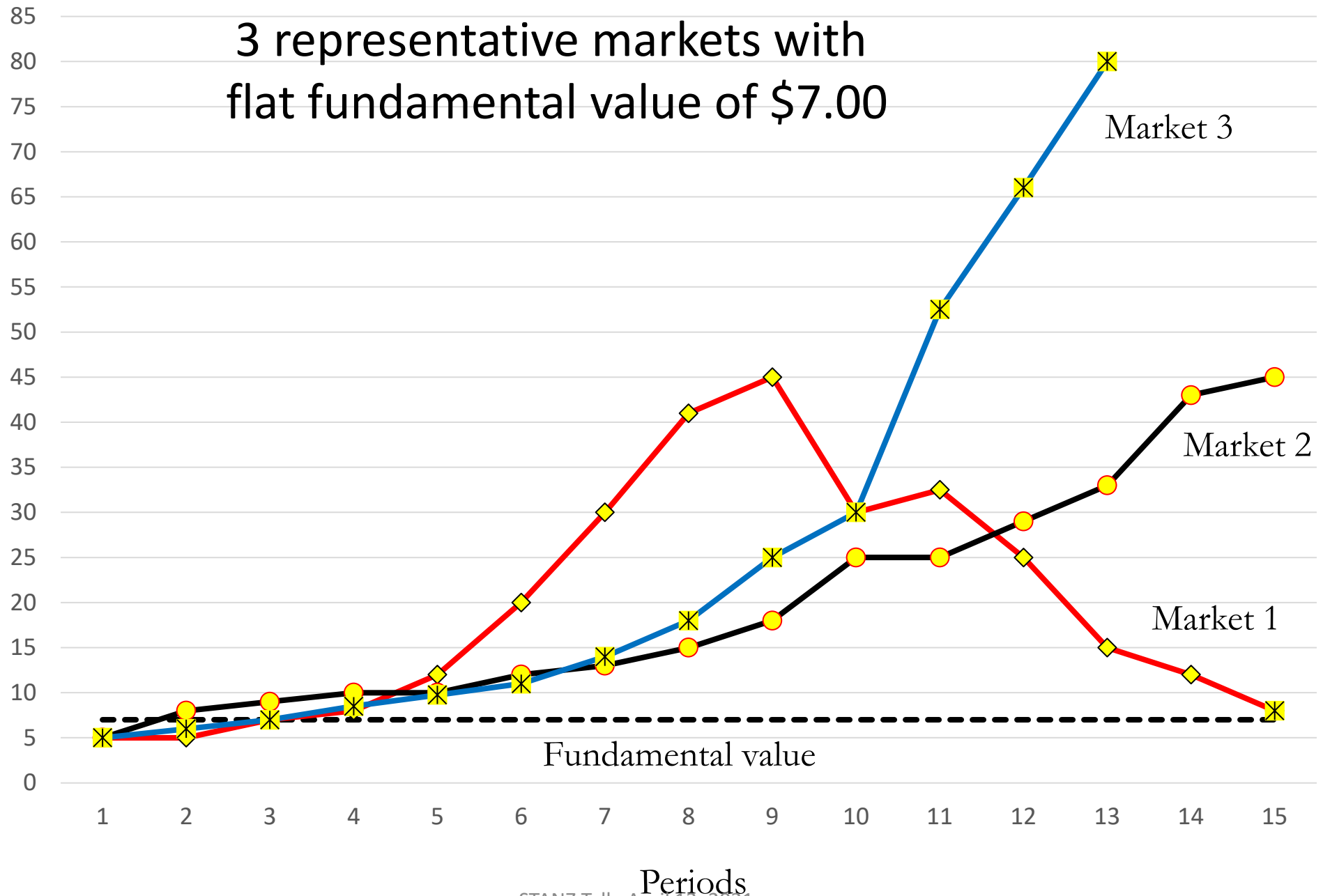
How about markets with a *flat fundamental value?*
A *flat fundamental value* is also a handy way
of depicting *infinitely-lived assets*
(using the *perpetuity formula*)

Fundamental value

Periods

3 representative markets with flat fundamental value of $7.00

Market 3

Market 2

Market 1

Fundamental value

Periods

# Rational speculation or bounded rationality?

- Speculation may be rational.

- If we assume that different traders have different expectations in the market, then it may well make sense for someone to buy shares at an inflated price as long as that trader believes that there is another trader, willing to pay an even higher price.

- So, the bubbles-and-crashes may be generated by a mixture of rational and irrational traders, the latter referring to traders who are more likely to make mistakes in terms of timing of buying/selling.

# Rational speculation or bounded rationality?

- But given that prices in almost all cases eventually crash back down toward the fundamental value, why are traders not able to anticipate this crash?

- Anticipating the crash requires the traders to engage in *backward induction arguments.*

- *This is not easy; particularly for those with little experience in the institution.*

# Rational speculation or bounded rationality?

- Instead, many traders engage in naïve behaviour based on their (often myopic) forecasts of what they expect to happen to the price.

- Price forecasts are not accurate and most traders use current prices as the basis of their future forecasts.
  - *Adaptive or backward looking expectations*

- Once the price starts to deviate from the fundamental value, traders seem to believe that the fundamental value is no longer the primary concern but base their future forecasts on current prices.

# Rational speculation or bounded rationality?

- Re-create the original study by assigning a single role to each trader, ***either as a buyer or as seller.***

- A buyer is endowed with cash, with which she can buy shares but cannot sell any shares (even ones bought during the game)

- Similarly, sellers have shares to sell but no cash and are also not allowed to buy shares.

# No speculation markets

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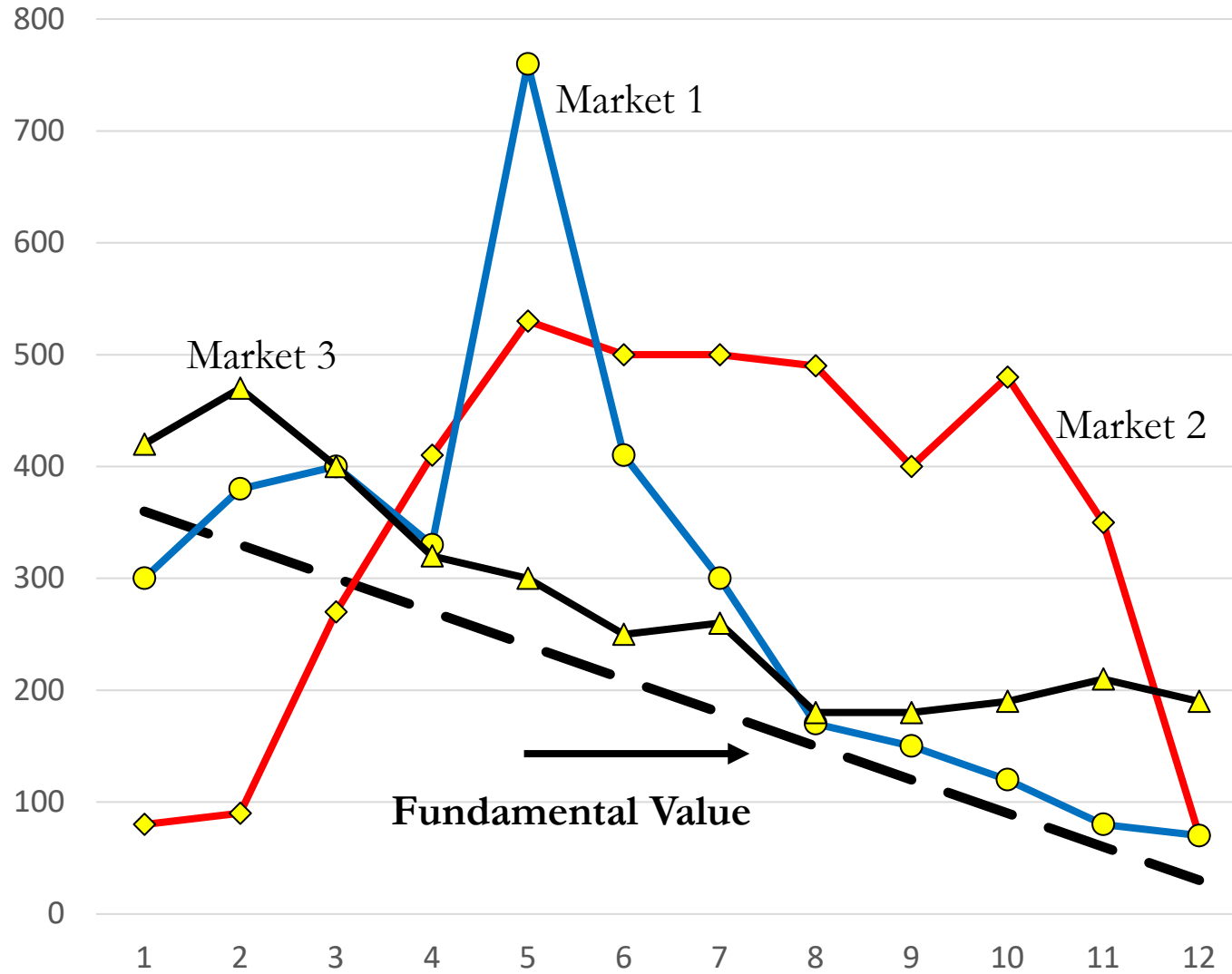
# Animal spirits (lack of self-control)?

- Kocher, Lucks and Schindler interpret Keynes' animal spirit as lack of self-control.
- When others are buying, even at inflated prices, the urge to buy becomes overpowering.
- Correlational evidence to suggest that self-control (or lack thereof) may play a role in ***momentum trading*** and price bubbles.
- Kocher and his colleagues want to establish causality;
- It is the lack of self-control that leads to bad trades rather than bad trading outcomes resulting in stronger emotional responses.
- Kocher et al. turn to the Stroop Task.

# The Stroop Task (Name the *colour*)

- RED
- GREEN
- GREEN
- BLUE
- RED
- BLUE
- GREEN
- BLUE
- RED

- RED
- GREEN
- GREEN
- BLUE
- RED
- BLUE
- GREEN
- BLUE
- RED

# Unleashing and leashing animal spirits

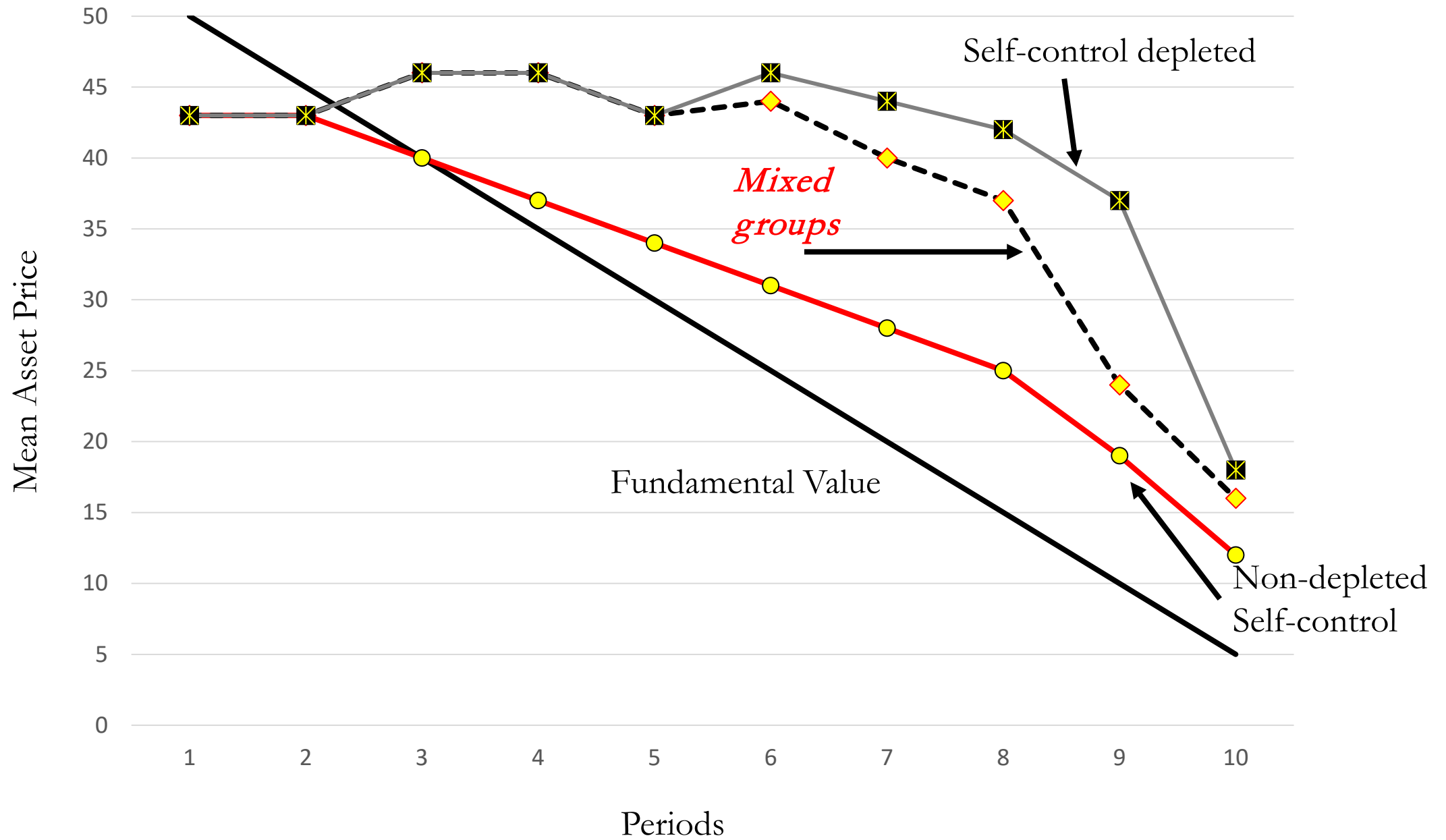- Participants are assigned to two different groups, one with *"Depleted"* and the second with *"Non-depleted"* self-control.

- Both groups perform this task for 5 minutes and are presented with many such words on successive screens.

- Those in the former group saw the conflicting messages on every screen for those 5 minutes, while those in the latter group saw this conflict once every 70th screen.

# Unleashing and leashing animal spirits

- The idea, here, is that the former group who has to exercise much greater self-control than the latter will end up depleting their reservoir of self-control

- Will find it much harder to desist from driving prices up in the ensuing asset trading game, especially when others are doing so.

- We should expect to see greater amounts of ***momentum trading*** as well as larger and longer lasting asset bubbles among those traders whose self-control has been depleted.

Mean Asset Price vs Periods. Chart showing Self-control depleted, Mixed groups, Non-depleted Self-control, and Fundamental Value.
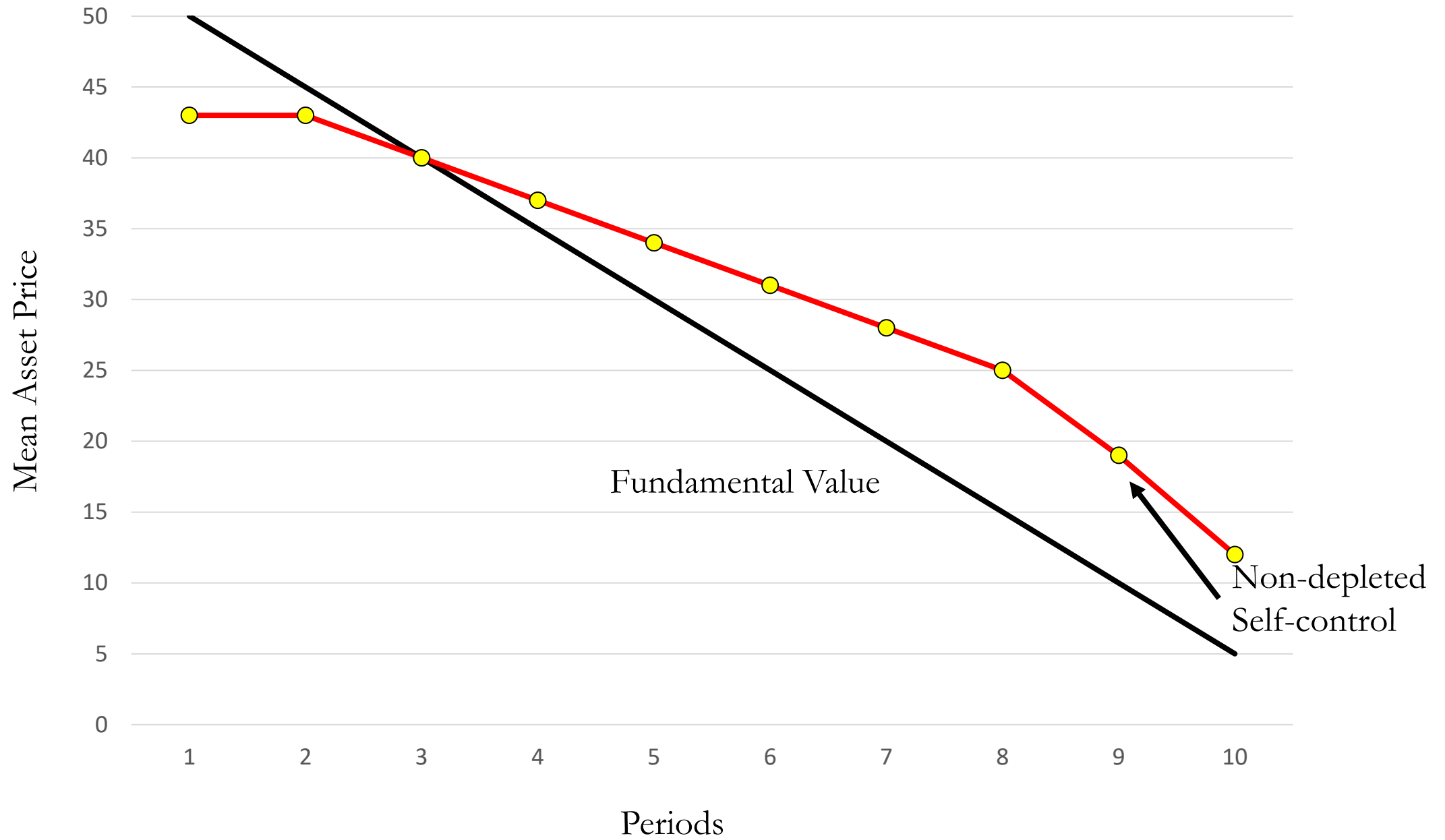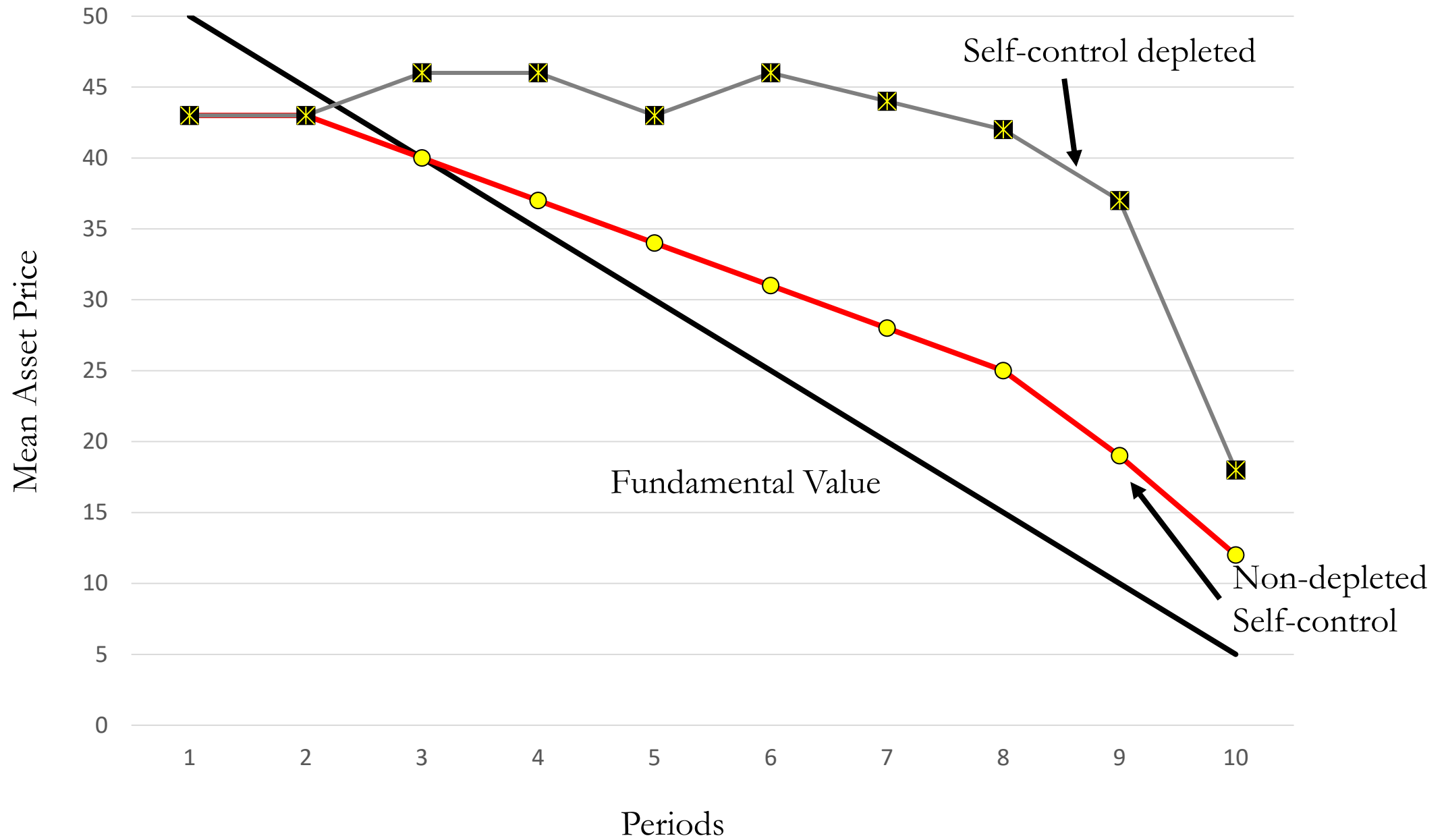
# Unleashing and leashing animal spirits

- Kocher et al. conclude that:

- *Together, these findings suggest that self-control depleted traders become more reliant on heuristics, are much more emotion driven, and rely less on their cognitive skills to find optimal trading strategies.*

# Unleashing and leashing animal spirits

- Julija Michailova of Hamburg and Ulrich Schmidt of Kiel look at another likely culprit: **Overconfidence.**

- Participants first take part in a general knowledge quiz.

- Each question has three possible answer of which the participant has to choose one.

- For each option, each participant indicates how confident she is about her answer.

- These can range from 33% (complete uncertainty; since given three options there is a 33% chance that one of them will be correct) to 100% (complete certainty).

# Unleashing and leashing animal spirits

- Michailova and Schmidt then compute a *bias score* for each participant.

- Suppose a participant said that she was 100% sure of all her answers but in reality, only 60% of her answer were correct, then her bias score is 40%.

- A positive bias score means over-confidence, a negative bias score means under-confidence and a bias score of zero implies a person who is accurately calibrated (confidence neutral).

- In keeping with prior findings, these authors find that participants tend to be over-confident with mean over-confidence of approx. 12%.

# Unleashing and leashing animal spirits

- A few weeks later, these participants are invited to come to the lab and take part in an asset market study using the same protocols as in Smith et al.

- Participants are endowed with cash and some shares and trade for 15 periods.

- In any period, the potential dividend values are $0, $0.08, $0.28 and $0.60, implying an expected dividend of $0.24.

- So, at the beginning of the session, the expected dividend from the asset is $3.60, declining to $0.24 by Period 15.
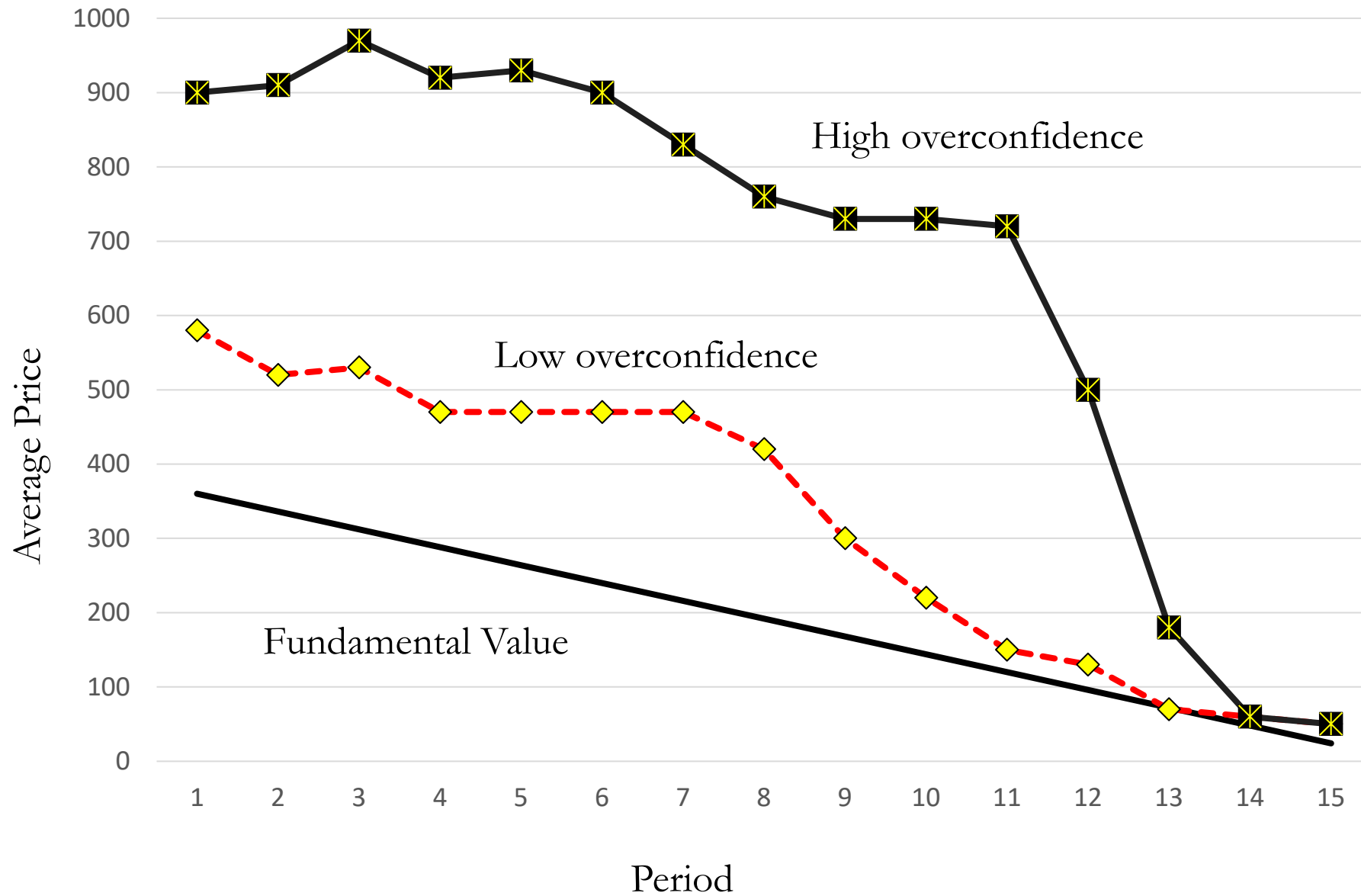
# The role of experience

- So, are we then doomed to succumb to such "animal spirits" in our trading activities?

- Not necessarily.

- The papers that show the existence of such animal spirits also provide implicit clues as to how such may be curbed.

- It is possible to teach people not to fall prey to over-confidence by being made aware of its existence.

- Similarly, one can exercise self-control via commitment devices.

# The role of experience

- As Smith et al. noted, the best prescription for reducing asset bubbles is greater experience on the part of traders.

- Haruvy, Lahav and Noussair extend earlier work by delving into the role of experience.

- If it is indeed the case that traders rely on simple rules-of-thumb then, *such heuristics are more likely to be successful when traders have more experience than less.*

# The role of experience

- 53 participants.

- There are 9 participants in each one of five sessions and eight in the other one.

- In each session, the participants take part in ***four different markets in sequence,*** with each market lasting for 15 periods. (60 rounds in all)

- Each of the four markets within a session resemble the Smith et al. markets.

- Participants start out the with an initial endowment of cash and shares.

- The share pays dividends, which takes one of 4 values in each round: $0.00, $0.04, $0.14 and $0.30 with an expected dividend of $0.12 in each round.

# The role of experience

- Haruvy and colleagues focus on the "peak price".
- This is the highest share price attained during the operation of a marke.
- The highest price in a market represents a turning point in that the price will start to decrease from this point on.
- If prices followed the fundamental value, we expect the market price to be highest in period 1 and then decline from that point on.
- However, if there are indeed bubbles in the market, then we expect the price to start low and then peak in a later period and then crash.
- So, the price peaking earlier in the market is consistent with convergence to the fundamental value.
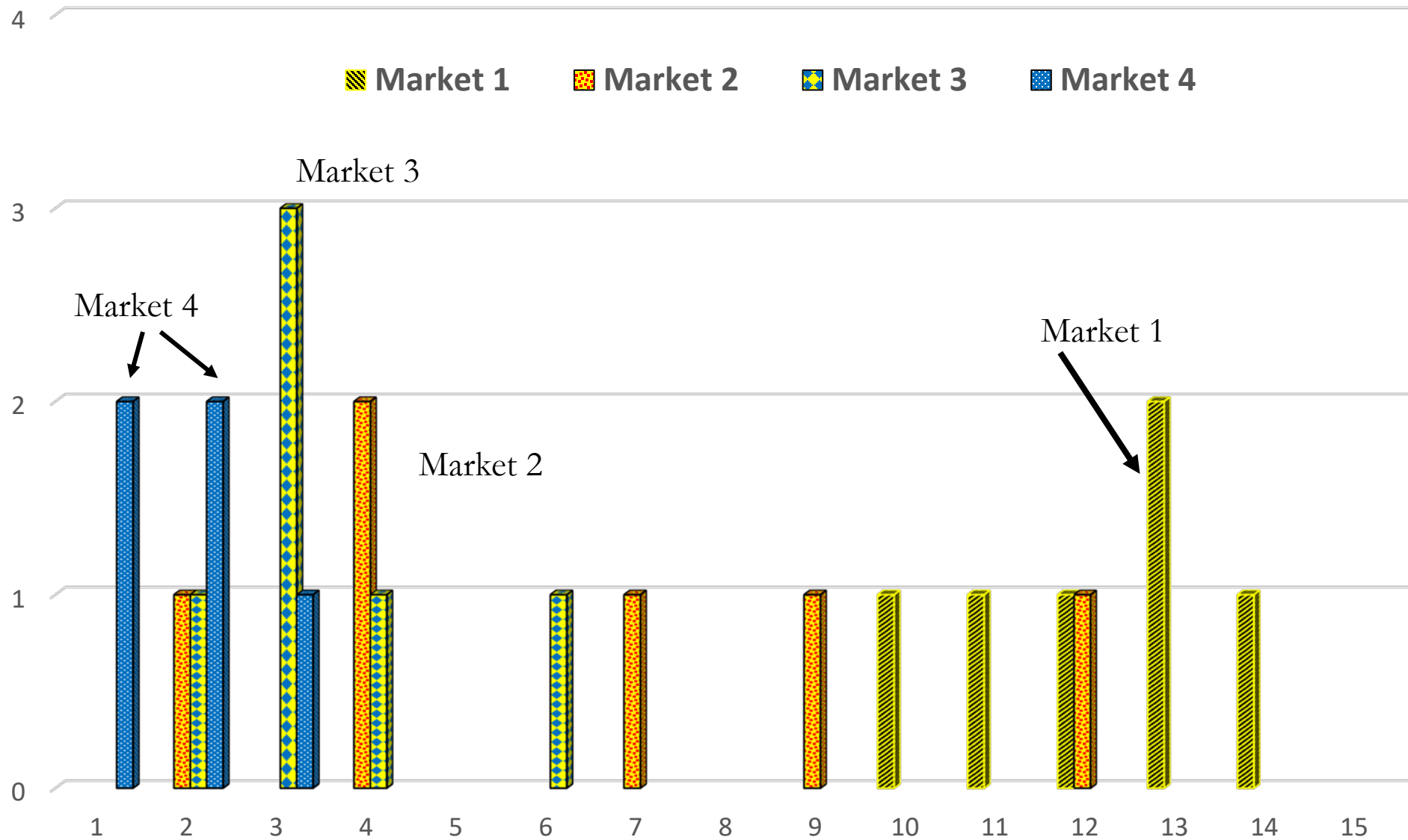
Period where the market price "peaked"

# Summary

- Price bubbles in markets for financial assets occur on a regular basis.
- These are situations where a particular financial asset is trading at a price much higher than what it really should be worth.
  - South Sea Bubble in the early 18th century;
  - Tulip Mania in the 17th century;
  - US housing bubble in the early part of the 21st century.
  - So-called "dot-com" bubble also during the late 1990s and early 2000s where the prices of internet based "tech" companies went through the roof.

# Summary

- The effects of some of these bubbles can be more localized and when the bubbles burst the majority of the damage is confined to the investors.

- But, in some cases, such as the bursting of the US housing bubble, the consequences were far more widespread and devastating resulting in a global recession.

- Laboratory experiments can be set up as microcosms of such macroeconomic phenomena and provide a tractable way of studying asset bubbles

- The work done by Smith in this area has subsequently generated a very large literature and added to our knowledge of why and how such bubbles form.

# Summary

- Bubbles may form in markets for assets with declining fundamental value as well as flat fundamental values.

- The formation of bubbles depend not only on speculative motives but may also come about due to decisions errors by traders.

- Well-known behavioural biases such as lack of self-control and over-confidence can exacerbate such markets bubbles, to an extent by fuelling speculation in the anticipation of capital gains.

- Trader expectations play a crucial role in the formation of asset bubbles.

- Those who make better forecasts benefit at the expense of those who do not.

# Summary

- By and large, the major factor behind attenuating asset bubbles is trader experience.

- With greater experience the trajectory of prices track the fundamental value closely.

- But, acquiring this level of insight takes time and happens via the interaction of expectations, which depend on past history, and behaviour.

- As traders gain experience over markets, they anticipate prices to peak earlier.

# Questions?