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Bubbles and Crashes Revisited

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***A*bstract:** Based on the pioneering work of Smith, Suchanek, & Williams (1988) experimental researchers have concluded that assets markets are prone to bubbles and crashes in experimental settings. Numerous authors employing the SSW framework have incorporated features designed to reduce or eliminate the observed bubbles (e.g., circuit breakers, short selling, long-lived assets) with little success. This paper alters the underlying process determining the asset's fundamental value by incorporating a new experimental design feature. Its results indicate that asset prices and fundamental value can indeed deviate per SSW's original results, but the popular interpretation that markets will persistently bubble and crash is misconstrued. Indeed, it appears that rapidly decreasing fundamental values contribute to the bubble. In markets with slowly decreasing, constant or increasing fundamental values, bubbles and crashes are much less common, appearing when the asset price significantly deviates from fundamental value at the onset of the experiment. These interpretations hold in presence or absence of circuit breakers in the market.

JEL Classifications: C91, C92, G12
Keywords: Bubbles, Crashes, Experimental asset markets

1. Introduction

Smith, Suchanek, & Williams(1988) constructed an experimental asset market that consistently produced speculative bubbles above fundamental value that subsequently crashed. In the typical SSW style experiment, a finite-lived asset with periodic dividend payments determined by a known probability distribution is traded (generally in a double oral auction institution) by subjects endowed with a portfolio of cash and assets. The asset's fundamental value is defined as the discounted present value of all future expected dividend payments under the assumption of risk neutrality (i.e., simply the expected dividend payment times the number of periods remaining). As the experiment progresses period by period, the asset's fundamental value falls by the expected dividend payment. However, the observed transaction prices in the experiments begin below fundamental value in the initial periods, move higher in the middle periods and later crash to or below fundamental value in the later periods.

This rational expectations pricing violation has generated intense interest both to theoretically explain the results and to manipulate the experimental design to eliminate the pattern. In addition, the 1987 stock market crash and the implementation of circuit breakers based on the 1998 Brady

Commission (Presidential Task Force on Market Mechanisms, 1998) recommendations highlight the practical importance of this stream of research.

On the theoretical front, a number of papers have put forth explanations for the phenomenon most of which specify some failure on the part of the traders:

- Failure of the backwards induction process to determine the current market price from expected future dividends for numerous reasons[1]: infinite asset maturity/trading periods - Blanchard & Watson (1982), Allen & Gorton (1993), and Allen, Morris, & Postlewaite (1993), noise trader risk - DeLong, Shleifer, Summers, & Waldmann (1990a) and DeLong, Shleifer, Summers, & Waldmann (1990b) and heterogeneous beliefs - Allen, Morris, & Shin (2006);
- Inability of arbitragers to collectively act to correct prices - Abreu & Bunnermeier (2003);
- Lack of common rational expectations in early to mid periods despite common information- Smith, Suchanek, & Williams (1988);
- Focus on trading profits without regard to fundamental value (Speculation Hypothesis) - Plott (1991);[2]
- Excessive trading occurs because there is nothing else for participants to do yet the experimental design encourages participation (Active Participation Hypothesis) - Lei, Noussair, & Plott (2001).

On the experimental design front, different features have been incorporated to eliminate/ remediate the market behavior. A subset is reviewed below, while the reader is referred to Porter and Smith (2003) and Porter and Smith (2008) for a more complete review:

- circuit breakers - Ackert, Church, & Jayaraman (2001);
- presence of informed traders with private information - Ackert, Church, & Jayaraman (2005);
- extremely long lived assets - Lahav (2011);
- capital gains taxes - Lei, Noussair, & Plott (2002);
- margin accounts and short selling - King, Smith, Williams, & Van Boening (1993);
- call markets instead of continuous double auction market – Van Boening, Williams, & LaMaster (1993);
- futures markets and fixed risk free dividend payments - Porter & Smith (1995).

Despite these enhancements to the SSW framework, the bubble-crash behavior has been remarkably robust to experimental design alterations. Two experimental design changes have impacted the bubble-crash pattern: the use of experienced traders (i.e., traders who have already participated in such experiments) and the delay of dividend payments.

Dufwenberg, Lindqvist, & Moore (2005) and Ackert & Church (2001) document that bubbles are of a smaller magnitude and dissolve more quickly when a subset of the traders is experienced.[3]

[1] See Hirota & Sunder, 2007 for a more complete description.

[2] It should be noted that Lei, Noussair, & Plott (2001) present compelling evidence showing bubbles still exist in markets without the ability to speculate by traders. Based on their results, speculation may contribute to bubbles but is not necessary for them to occur.

[3] King, Smith, Williams, & Van Boening (1993) and Porter & Smith (1995) also present similar evidence. The above papers repeated the experiments with the identical pool of experienced traders, whereas Dufwenberg, Lindqvist, & Moore (2005) and Ackert & Church (2001) mixed experienced traders with new inexperienced traders.

These experiments use the SSW design where fundamental value rapidly declines. If these experienced students are aware that the "rug was going to be pulled out" from under them, so to speak, did they then moderate the bubble? Hussam, Porter and Smith (2003) find similar evidence with experienced traders, but interestingly, they find that changes in the experimental design (increases in liquidity and payoff uncertainty) can "re-ignited" bubbles.

Papers have examined the bubble-crash pattern with constant fundamental value. Examples include Hirota & Sunder (2007), Van Boening, Smith, & Wellford (2000), Noussair, Robin, & Ruffieux (2001) and Kirchler, Juergen, & Stockl (2012).

In Hirota & Sunder (2007) the asset pays a single cash flow at the end of the experiment resulting in a constant fundamental value. The primary purpose of this paper was not to alter the fundamental value's path during the experiment *per se* but to compare market behavior when the market is populated with short-term traders *versus* long-term traders. Long-term traders remain in the experiment until the terminal dividend is paid, and the authors argue they are more likely to use backwards induction to determine the asset price given the terminal dividend payment. Short-term traders expect to exit the experiment before the terminal dividend. These traders will liquidate their holdings at the expected asset value in the exit period. Since they do not receive any dividend payment, it is argued they will forward induct to form their expectations of the liquidating exit price. Hirota and Sunder conclude the evidence supports this latter hypothesis. In particular, they find markets with short-term traders are prone to bubbles: "in markets populated by short-term investors…prices tend to lose their dividend anchors, can take any value…and are susceptible to bubbles,"[4] while those with long-term traders convergence to fundamental value.[5]

In Van Boening, Smith, & Wellford (2000) the timing (and number) of dividend payments is altered to examine six hypotheses concerning the causes of bubbles. In one treatment, the asset pays a single dividend in the terminal period resulting in constant fundamental value. In this treatment, they observe only one out of ten markets experiencing a bubble. In treatments with multiple dividends, the occurrence of bubbles becomes more frequent and more pronounced. They conclude "the concentration of dividend value in time helps create common endogenous expectations, and thus reduces bubbles." Alternatively, could these results be evidence to support the impact of rapidly declining fundamental value?

Noussair, Robin, & Ruffieux (2001) answer the above question with a negative response. In their paper, the asset either earns a dividend or incurs a holding cost (negative dividend) each period according to a probability distribution such that the fundamental value is constant in each period.[6] They find asset prices deviating above and *below* fundamental value and "crashing" towards fundamental value. Indeed it appears the "anti-crashes", asset prices below fundamental value exploding upwards, are a result of the negative dividend payments. Consistent with Van Boening, Smith, & Wellford (2000), they conclude "the fact that a single dividend is paid in the Smith et. al. (2000) study … served to preclude the bubbles, not the fact that the fundamental value was constant over time."[7] This is the first paper to our knowledge to explicitly call into question the declining fundamental value path and appears to have been accepted as the definitive statement on the issue.

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[4] Hirota & Sunder (2007), p3.

[5] Of relevance to this paper, it appears long-term traders are able to move the market to fundamental value when fundamental value isn't declining rapidly. Second, Hirota & Sunder (2007) use a random end period in the experiments with short-term traders.

[6] An additional alteration found in this paper is that the positive and negative dividends changed the calculated earnings for each subject, but did not change the amount of cash available for purchases in the next period.

[7] Noussair, Robin, & Ruffieux (2001) do find smaller bubbles in constant fundamental value markets.

Recently, Kirchler, Juergen, & Stockl (2012) reexamine markets with constant and declining fundamental value through the use of positive and negative dividends payments. They conclude that "declining fundamental value is the main driver for mispricing and overvaluation."

In summary, Van Boening, Smith, & Wellford (2000) and Noussair, Robin, & Ruffieux (2001) argue that markets with multiple dividends are prone to bubble and crash regardless of the fundamental value path. In contrast, Hirota & Sunder (2007) argue markets are better behaved with constant fundamental value (single dividend payment) and Kirchler, Juergen, & Stockl (2012) argue markets are less well behaved with declining fundamental value (multiple positive or negative dividend payments).

The use of negative dividends to create a constant fundamental value is quite different than the original SSW framework. Furthermore, from a practical standpoint, assets do not pay negative dividend payments. From a theoretical standpoint, Prospect Theory (Kahneman & Tversky, 1979) would argue the gains from positive dividends would be viewed differently than the losses from negative dividends. Accordingly, it appears the use of negative dividend payments should be avoided for both practical and theoretical reasons.

If the payment of multiple dividends is important, we should observe the same bubble – crash pattern regardless of the fundamental value path. To examine this conjecture, we create an experimental design in which the experiment's ending period is random and assets have positive redemption values[8]. The redemption value is adjusted each period so fundamental value can decrease, increase or remain constant, while the asset pays a *positive* dividend payment according to a known probability distribution. In effect, the changes in the redemption value temper the decrease in fundamental value from dividend payments. Using this design, we can manipulate the fundamental value over time while avoiding negative dividends. Accordingly, we present results from experiments with decreasing, constant and increasing fundamental value, half with and half without incorporating circuit breakers. In markets without rapidly declining fundamental value, we find asset prices can indeed deviate from fundamental value; however, we do not consistently find the bubble-crash pattern displayed in previous experiments. As such, we posit rapidly decreasing fundamental value plays a contributing factor in the regularity of the SSW results.

2. Experimental Design[9]

Students were solicited for the experiments from economics classes at two Midwest universities – a smaller technical university and a large major research university. The subjects were told they would receive an $8 participation fee and further earnings determined by the decisions they made in the experiment. Each trader was randomly endowed with a portfolio that included cash (experimental francs) and certificates. Each trader's portfolio was equally valued with half high in cash and half high in certificates. The value of each trader's initial endowment was determined by the fundamental value of the certificates in the first period and the stated redemption value of their cash endowment. Each trading period lasted four-minutes, and subjects could purchase or sell certificates in a double oral auction format with a "tickertape" showing all bids and offers. No short selling or margin purchases were allowed. At the close of each trading

[8] As noted in Noussair, Robin, & Ruffieux (2001) a terminal redemption value was paid in some of the original experiments in Smith, Suchanek, & Williams (1988). While this increased the overall fundamental value of the asset, the rapid decrease in fundamental value remained.

[9] The experiments reported here are subsets of a larger set investigating the effect of circuit breakers in experimental asset markets.

period, a bingo ball was drawn to determine the dividend state: high or low, each with equal probabilities.[10]

After the dividend was drawn, a card was drawn to determine if the experiment continued.[11] The experiment began with one "stop" and nine "continue" cards and they were drawn without replacement. Upon drawing the "stop" card, the experiment terminated and the certificates were redeemed according to a schedule found on the front page of the subject's instruction sheet. A typical redemption schedule is reproduced here (Table 1).[12]

Table 1. A typical redemption schedule

Period	Redemption value for each certificate
1	0
2	100
3	200
4	300
5	400
6	500
7	600
8	700
9	800
10	900

Varying the redemption value allows the certificate's fundamental value to increase, decrease or remain constant during the experiment.

Subjects in these experiments have three potential sources of earnings; capital gains from trading certificates, dividends paid on certificates held, and the certificate's redemption value at the termination of the experiment. These experiments were conducted with or without circuit breakers present for all periods. Our circuit breaker procedure establishes a 10% band around the price of the first certificate trade in period one.[13] As explained in the instructions, any trade at a price strictly outside the band is consummated and then trading ceases for 30 seconds or the period ends if less than 30 seconds remain. At the end of the halt another band around this new price would be established, and trading continues.[14]

The parameters used in this series of experiments were:

1. Dividend states: high 100 francs, low 20 francs
2. Expected dividend: 60 francs
3. Periods: 10 max, actual number randomly determined
4. Probability experiment ends: 1 in 10 for period 1, 1 in 9 for period 2, 1 in 8 for period 3, …, 1 in 1 for period 10
5. Fundamental values:
    a. No circuit breakers: constant: all at 600 francs, decreasing- 600 to 60, 920 to 420, 825 to 420, increasing- 1050 to 1500, 1000 to 1500, 1050 to 1500 (twice)

[10] Prior to the first period one of the subjects was chosen to investigate the bingo cage containing 36 balls numbered 1 - 36. The balls 1-18 signify the high dividend state, 19-36 low. The subjects "drew" a ball, with replacement, from the cage at the end of every period.

[11] As with the bingo balls, a subject certified that there were 9 blank (continue) and one "stop" card. The cards were placed in envelopes and the subjects selected an envelope at the end of each period to determine whether the experiment continued or stopped.

[12] For this session with an expected dividend of 60 francs per period and the above redemption values the fundamental value varies from 780 in period 1 to 960 francs in period 10.

[13] Our circuit breaker is modeled after the NYSE's methodology and differs from those used by others in the literature. See Ackert, Church, & Jayaraman (2001) and Ackert, Church, & Jayaraman (2005) for examples of other breakers.

[14] The upper and lower limit of prices that would not trip the breaker was visible to all subjects throughout the session.

b. Circuit breaker: constant- all at 600, decreasing- 600 to 60 (three times), increasing- 780 to 960, 880 to 1060, 1018 to 1310

6. Average expected earnings were $15 including participation payment. Actual payments were highly variable.

3. Experimental Results

The results for experiments lasting longer than the five periods are presented here. A graph of the asset price relative to the period's fundamental value is shown for different fundamental value paths. In order to examine our "pulling the rug out" conjecture, we begin with declining fundamental value experiments before altering the redemption schedule to produce a set of experiments with constant and increasing fundamental value.

As we have pointed out, numerous features (circuit breakers, long lived assets, short selling, etc.) have been incorporated into the SSW design in an attempt to mitigate the bubble/crash behavior. We suspect these prior treatments will have little impact on the overall asset price behavior in our market setting. In order to confirm this belief, additional experiments are presented with circuit breakers in place.

3.1 Rapidly Declining Fundamental Value

In Market 1 (without circuit breakers) and Markets 2, 3 and 4 (with circuit breakers), we employed the random ending period design with fundamental value decreasing rapidly per the original SSW framework. In particular, the fundamental value declined from 600 in period one to 60 to period ten (or a zero fundamental value after the terminal period's dividend payment). For each period, the average price divided by the fundamental value for that period is graphed in Figure 1. As shown in Figure 1, Markets 1, 3 and 4 experienced the bubble – crash pattern while prices were more closely aligned with fundamental value in Market 2.

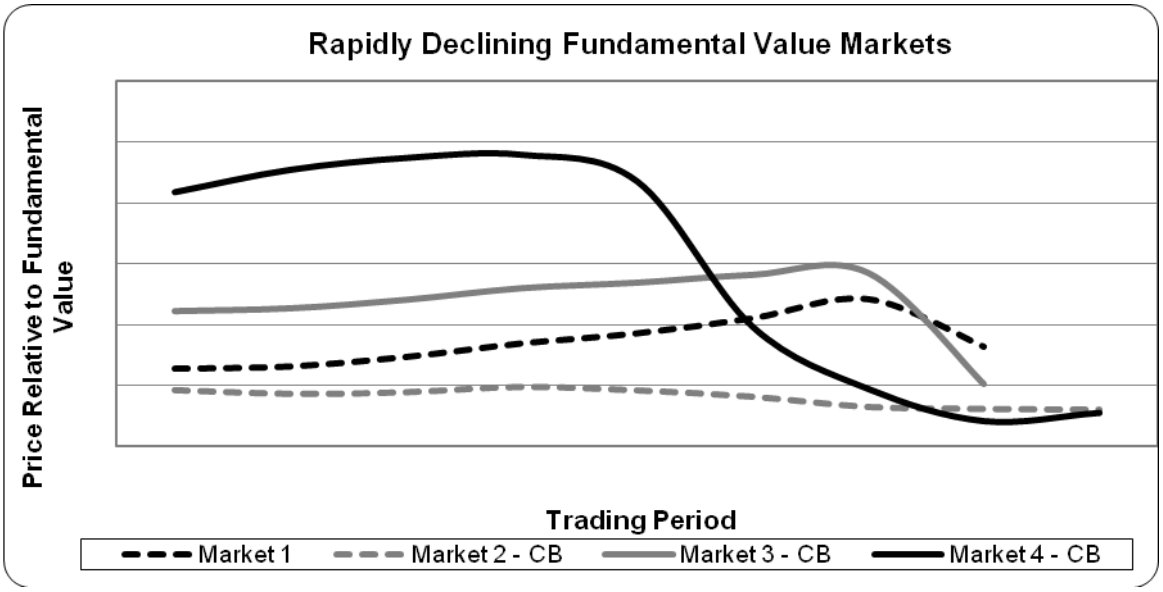

Figure 1. Rapidly Declining Fundamental Value Markets

Figure 2 displays the volume each period relative to the average volume per period over the entire experiment. Average volume per period ranged between 10 and 12 for these experiments. Starting with SSW, prior researchers have noticed a marked decline in trading volume during the

crash. Consistent with this prior observation, trading volume was lighter during the crash for the three markets that experienced a crash. While the "stop" card was drawn immediately after the crash in Markets 1 and 3, trading volume was large following the crash in Market 4.

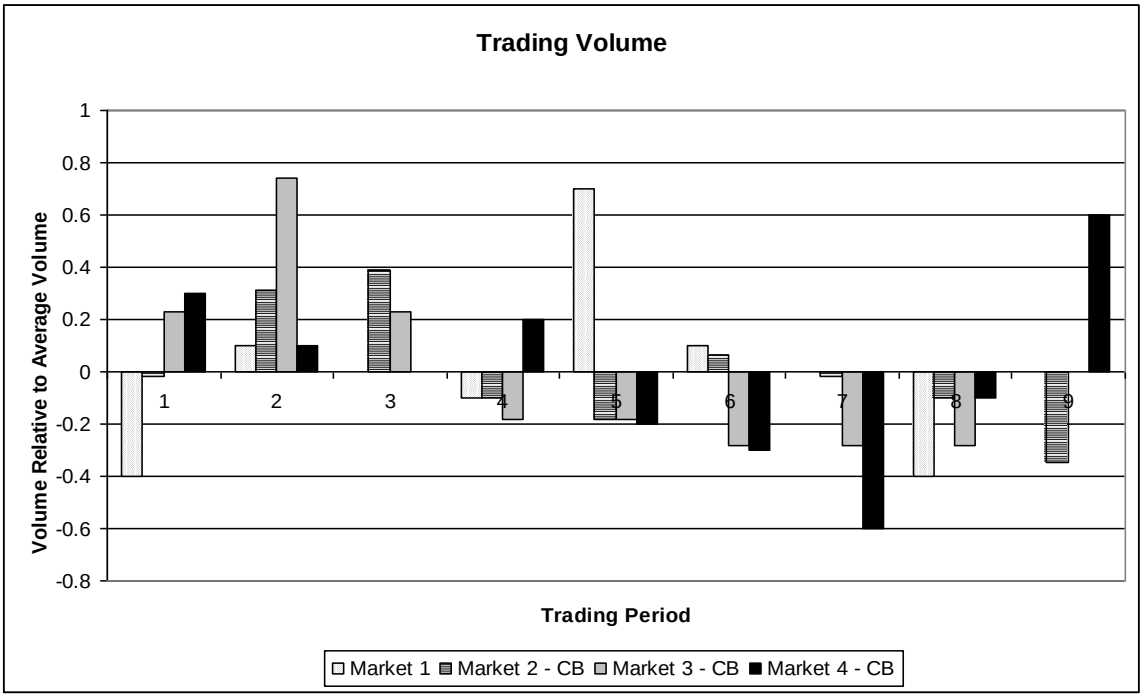

Figure 2. Trading Volume in Rapidly Declining Fundamental Value Markets

Overall the pricing and volume results match the prior results and indicate the random ending period design does not alter the 'typical' SSW results. In accordance with the prior circuit breaker research, bubbles and crashes still occur in the presence of a circuit breaker within our random ending period framework as well. As this point the standard conclusion is reached; namely, experimental markets are prone to bubbles and crashes. However we should only conclude that markets experience a bubble and crash when the "fundamental value rug" is pulled out from under traders.

Examining the early periods of Markets 1, 3 and 4 in relative terms (as was done in the SSW paper), it appears asset prices are moving upwards, however this is not the case. In all three of these markets, asset prices moved in the same direction as fundamental value during the bubble period. However, the dramatic decrease in fundamental value each period exceeded the downward movement in asset prices. Quite simply, the SSW bubble doesn't occur because asset prices explode upwards but rather because fundamental value is free falling. In fact, if markets are truly prone to bubbles, we should see them regularly occurring with constant and increasing fundamental values as well. Bubbles that occur in actual financial markets are quite different than the bubbles found in the SSW market. In particular, bubbles in actual financial markets are associated with substantial increases in asset prices – not decreasing asset prices unable to match rapidly decreasing fundamental values. Further, actual financial markets do not display the regularity and frequency of bubbles found in the SSW experiments.

3.2 Moderately Declining Fundamental Value

As shown in Figure 3, Market 5 presents a moderately swift decrease in fundamental value (960 to 420 francs over ten periods). In particular, the asset experienced the same absolute 540-franc decrease in fundamental value, but in relative terms the decrease in fundamental value was less severe. Bars around the average price indicate the highest and lowest price during each period. Trading volume is displayed using the secondary axis. Examining the graph, we see the asset trades at a 25% premium to the fundamental value during the first four periods. Unlike Markets 1, 3 and 4, the relative price does not move upwards; rather the relative decline in asset prices matched the relative decline in fundamental value. The previous pattern in trading volume is not observed in this market. With moderately decreasing fundamental value, the bubble and crash pattern is much less pronounced.

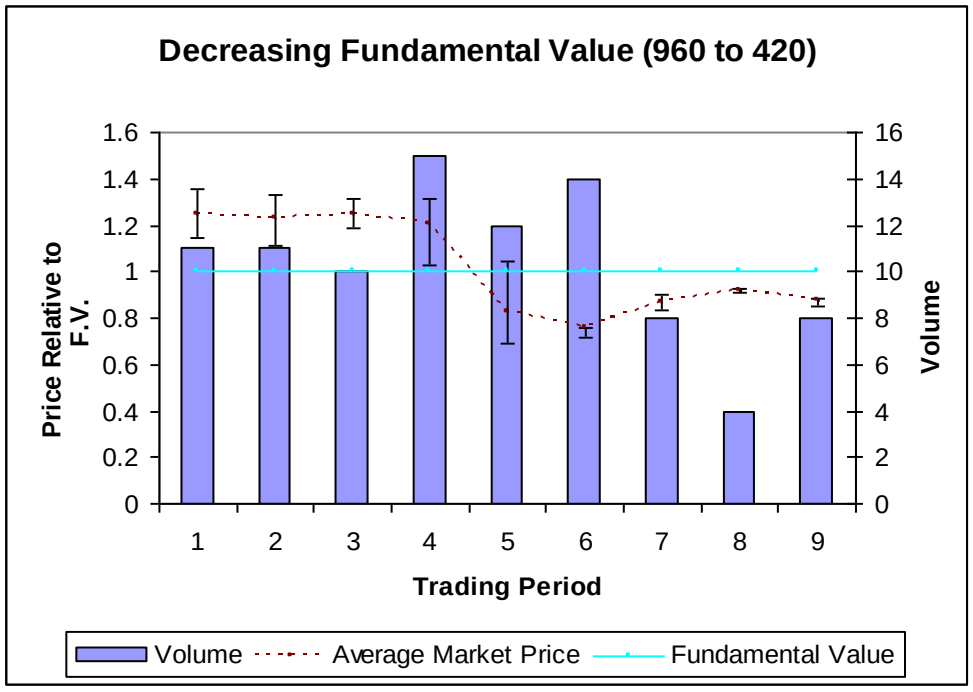

Figure 3. Moderately Decreasing Fundamental Value in Relative Term

In Market 6, as displayed in Figure 4, the decrease in fundamental value (805 to 420) in both absolute and relative terms was smaller than in Market 1 and 2. Although the asset prices traded at a large premium throughout the experiment, the market did not experience a bubble and crash pattern.

In summary, it appears asset prices can and do deviate from fundamental value in markets with declining fundamental value. While rapidly declining fundamental value provides an environment to observe these deviations with regularity, we should not conclude that markets are prone to bubbles and crashes from this single treatment of fundamental value.

3.3 Constant Fundamental Value

Fundamental value was held constant at 600 francs in Markets 7 - 10 (without circuit breakers) and in Markets 11 - 13 (with circuit breakers). As seen in Figure 5, we observed markets originating with all three possible initial asset prices: initial asset prices below fundamental value (Market 7, 10, 11, 13), initial asset prices equal to fundamental value (Market 9), and initial asset prices above fundamental value (Market 8, 12).

Pricing in Market 8 appears quite inconsistent with the other markets; however, trading volume was very small throughout this experiment. The average volume per period was less than five units over the first five periods. Regardless of whether reliable conclusions can be drawn from Market 8, these constant fundamental value markets are very well behaved overall compared to the SSW markets.

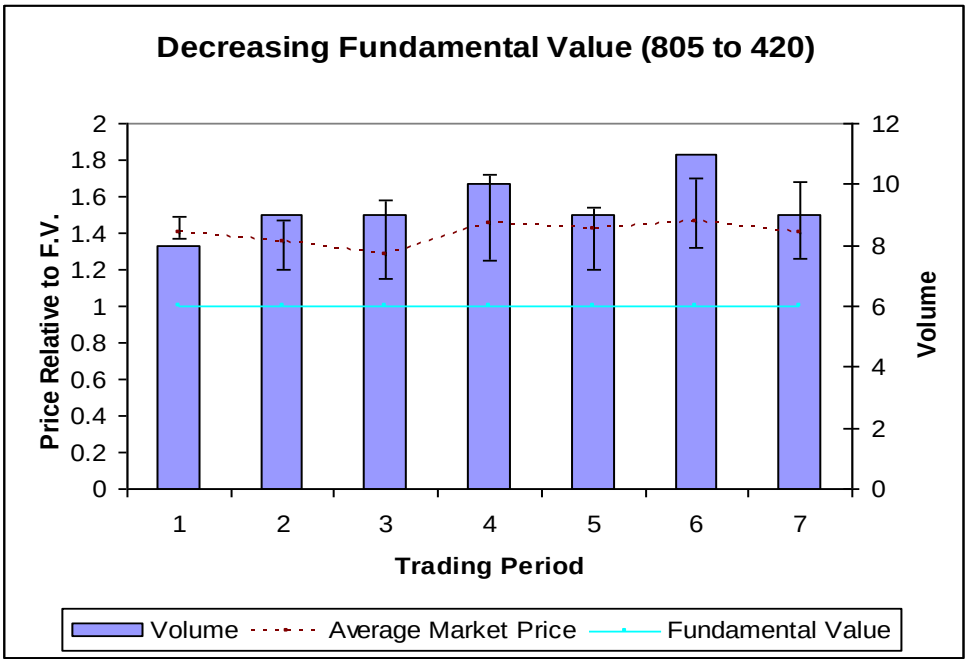

Figure 4. Moderately Decreasing Fundamental Value in Absolute and Relative Terms

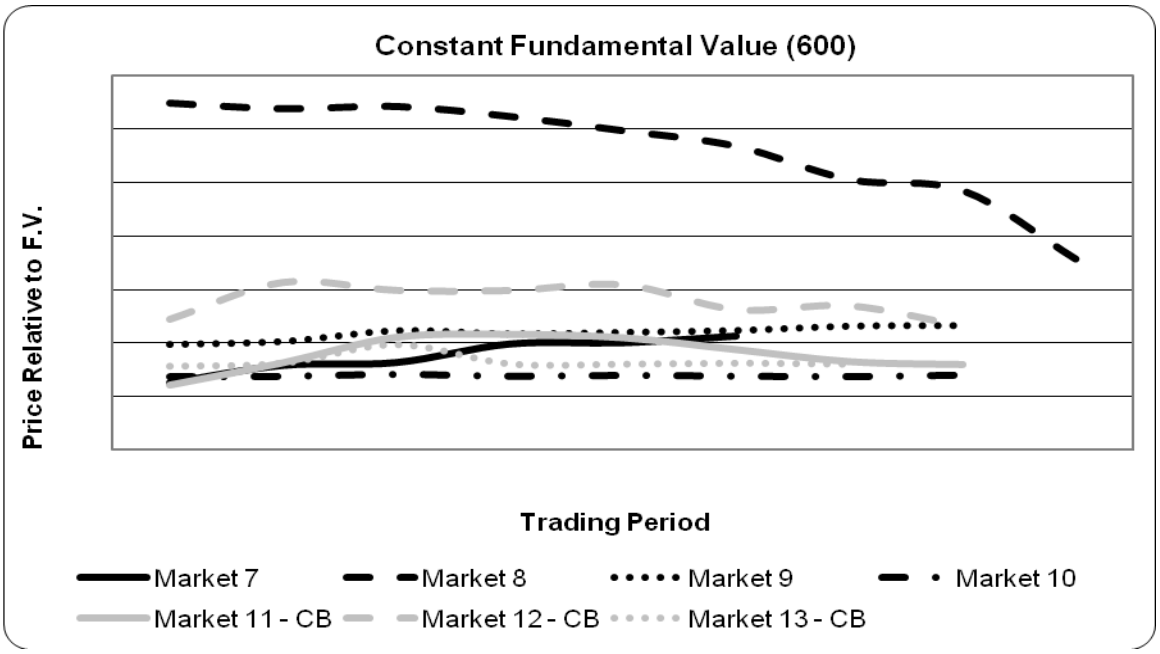

Figure 5. Constant Fundamental Value Market

In markets originating at a discount, prices remained constant or moved upwards without bubbling. In markets originating at a premium, asset prices declined over time in an orderly manner. While some upward drift occurred, Market 9 commences with asset prices equal to fundamental value without displaying bubble-crash behavior.

In summary, asset prices in markets with constant fundamental value do not display the bubble and crash pattern of SSW. Even in a market where asset prices began at a substantial premium, the decline in asset prices was more orderly than the traditional SSW results.

3.4 Increasing Fundamental Value

Next we examine the SSW framework with increasing fundamental value to determine the likelihood of bubbles and crashes. We increased fundamental value by large amounts (as much as 50%) in Markets 14 – 17 and by relatively small amounts (as little as 20%) in Markets 18 – 20. Markets 14 - 16 began with asset prices at a premium to fundamental value, whereas a discount occurred at the beginning of Markets 17 - 20. Results are shown in Figure 6 below.

Market 14 displays the nearest behavior to a bubble – crash pattern with an initial premium where upon asset prices fall below fundamental value. However even this market is different than the SSW results as asset prices (in both absolute and relative terms) did not increasing in any period which had a premium. As seen in Markets 15 and 16, markets that originate with substantial premiums are not destined to fall below fundamental value. Markets 15 and 16 started with a substantial premium and tracked towards fundamental value throughout the experiment without a crash.

Markets that began with asset prices at a discount demonstrated increases in prices that not only match the increase in fundamental value, but also reduce the discount. The reduction in the discount occurred whether the fundamental value was increasing rapidly (Market 17) or more slowly (Markets 18 – 20).

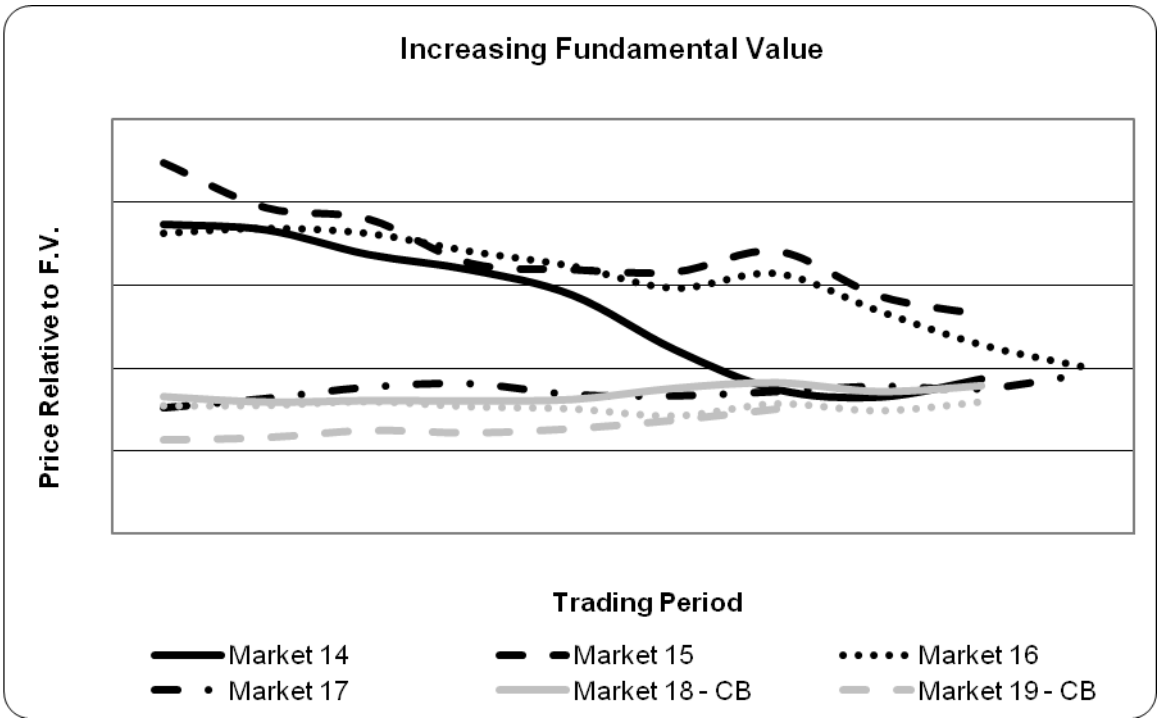

Figure 6. Increasing Fundamental Value Markets

In summary, the increasing fundamental value results are in agreement with the constant fundamental value results. These markets do not display the bubble and crash pattern of SSW. Even in markets where asset prices began at a substantial premium, the decline in asset prices are orderly in general. Further, asset prices did not move upwards to increase the absolute or relative premium in these markets. In fact, the relative price moved lower throughout the entire market unlike the traditional SSW results.

3.5 Summary

The aggregate results of Markets 1 – 20 show the following characteristics:

- Asset prices can deviate from fundamental value.
- Asset prices tend to track fundamental value.
- Markets with constant or increasing fundamental value are not as prone to bubbles as markets with rapidly declining fundamental value.
- In markets with constant or increasing fundamental value, the only evidence of a crash occurs if the market starts at a substantial premium to fundamental value. However, a crash is not a necessary result of a substantial premium.

Overall, these experimental findings support our contention that rapidly decreasing fundamental value is a driver of bubbles and crashes. Namely, bubbles and crashes are more likely to occur in markets with sharply decreasing fundamental value. In markets with constant or increasing fundamental value, prices are "well behaved" in the sense that bubbles and crashes do not occur and asset prices tend to move towards fundamental value over time and track changes in fundamental value.

One could argue the SSW result remains – but it simply needs to be stated more restrictively: experimental markets are prone to bubbles and crashes when fundamental value is free falling. While the debate can continue concerning this market failure, if the SSW bubble depends on such specific experimental micro-market structure and is not robust to alterations in the structure as previously believed, then it loses much of its power.

4. Empirical Results

Although the results presented thus far provide clear support for our "pulling the rug" hypothesis, we further support our hypothesis by examining two metrics. Kirchler, Juergen, & Stockl (2012) propose two measures, relative absolute deviation (RAD) and relative deviation (RD), to measure the amount of mispricing and the direction of the mispricing, respectively. These two measures are independent of the number of periods and the absolute level of fundamental value, which is important given our experiments incorporate random numbers of periods and changing fundamental values.

The RAD measure is defined as

$$RAD = \frac{1}{N}\sum_{p=1}^{N} \left| \overline{P_p} - FV_p \right| \Big/ \left| \overline{FV} \right|,$$

where p represents the period, N is the total number of periods, $\overline{P_p}$ is the mean price during period p, FV_p is the fundamental value during period p, and $\overline{FV}$ represents the mean fundamental value in the market. While large RAD values indicate large mispricing in the market, RAD measures this mispricing without regard to the sign/direction of the mispricing.

The RD measure indicates the direction of the mispricing. That is, positive RD values indicate overpricing, while negative RD values indicate under pricing.

$$RD = \frac{1}{N}\sum_{p=1}^{N} \left(\overline{P_p} - FV_p\right) \Big/ \left|\overline{FV}\right|$$

Taken together, the RAD and RD measures provide a more accurate picture of markets and allow comparison across experiments with changing fundamental values and changing ending periods. In particular, if one finds a large RAD and an equally large positive value for RD, this is an indication of a market that experienced a bubble. However, if one finds a positive RAD and a RD near zero, this indicates prices fluctuating around fundamental value.

Table 2 presents the mean RAD and mean RD by the fundamental value path for those markets with reasonable trading volume. As expected from Figure 1, markets with rapidly decreasing fundamental value markets experienced the highest mispricing as seen by the large RAD measure of 0.755. In markets with moderately rapid decreasing fundamental value, the amount of mispricing in the market is much lower than the rapidly decreasing markets and near the level observed in other markets. The markets with constant fundamental value, on average, experienced the lowest amount of mispricing with a RAD of 0.297.

While the RAD measures the amount of mispricing in the market, RD measures the direction of that mispricing. Again, positive RD values indicate overpricing, zero RD values indicate prices fluctuating around fundamental value and negative RD values indicate under pricing. Consistent with our "pulling the rug" hypothesis, markets with rapidly decreasing fundamental value experience large positive RD values that, while reduced, continue to persist in moderately rapid decreasing fundamental value markets. In markets with constant or increasing fundamental value, the RD measures display near zero values. Overall these results strongly support our hypothesis.

Table 2. Mean Relative Absolute Deviation and Mean Relative Deviation by Fundamental Value Path

Fundamental Value	RAD	RD
Rapidly Decreasing	0.755	0.674
Moderately Rapid Decreasing	0.297	0.224
Constant	0.232	-0.063
Increasing	0.310	-0.016

Following Kirchler, Juergen, & Stockl (2012), the Mann Whitney U test was used to test the null hypothesis that there is no difference in the population based on the RAD and RD samples for markets with decreasing fundamental value versus markets with constant or increasing fundamental value. Based on the Mann Whitney U test, we are able (unable) to reject the null hypothesis for the RD (RAD) measure at the 5% significance level. That is, while all markets experienced mispricing (RAD), the markets with decreasing fundamental value experienced overpricing (RD) not found in the other markets.

5. Conclusions

The bubble and crash phenomenon has become a mainstay in the experimental asset market literature starting with the seminal paper by Smith, Suchanek, & Williams (1988). Our paper compliments their results by documenting that asset prices can indeed deviate from fundamental value. However the now widely accepted conclusion that markets are prone to bubbles and crashes appears to be based on a design characterized by a rapidly decreasing fundamental value. Markets without this feature do not routinely exhibit bubbles and crashes.

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