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A Review of Research into Smith, Suchanek and Williams Markets

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Abstract

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JEL codes: D04, D01

Keywords: price bubbles, experimental asset markets

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ABSTRACT

This article is based on the results of 33 published articles and 25 working papers using the experimental asset market design introduced by Smith, Suchanek and Williams (1988). It discusses the design of a baseline market and goes on to present a database of close to 1600 individual bubble measure observations from experiments in the literature, which may serve as a reference resource for the quantitative comparison of existing and future findings.

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IN 1988, VERNON SMITH, GERRY SUCHANEK AND ARLINGTON WILLIAMS published the results of experiments which would go on to spawn a completely new twig on the then relatively young tree of experimental economic research. Earlier studies had used the double auction design (Smith, 1962), had studied intertemporal markets (Forsythe, Palfrey and Plott, 1982) or concerned themselves with the effect of employing securities with homogeneous value to all market participants (Smith, 1965). Yet it was the pioneering work of Smith, Suchanek and Williams (1988) (hereafter SSW) to combine all of the above characteristics into one experimental market design. To their surprise, the design, which they expected to create relatively efficient market prices, yielded large deviations from fundamental value, following classical bubble and crash patterns. Since then, hundreds of SSW-type markets have been run, yielding valuable insights into the factors governing the occurrence and extent of bubbles in financial market prices, into the efficiency-related properties of a number of variations in market mechanisms, and into the behavior of economic agents. Figure 1 documents the number of published studies and working papers in the literature to date. For a recent overview of these, see Palan (2013).[1]

[1] Note that this review evolved from a working paper version of Palan (2013). The reader is therefore asked to excuse similarities in some sections of the two papers (mainly the introduction and the first chapter).

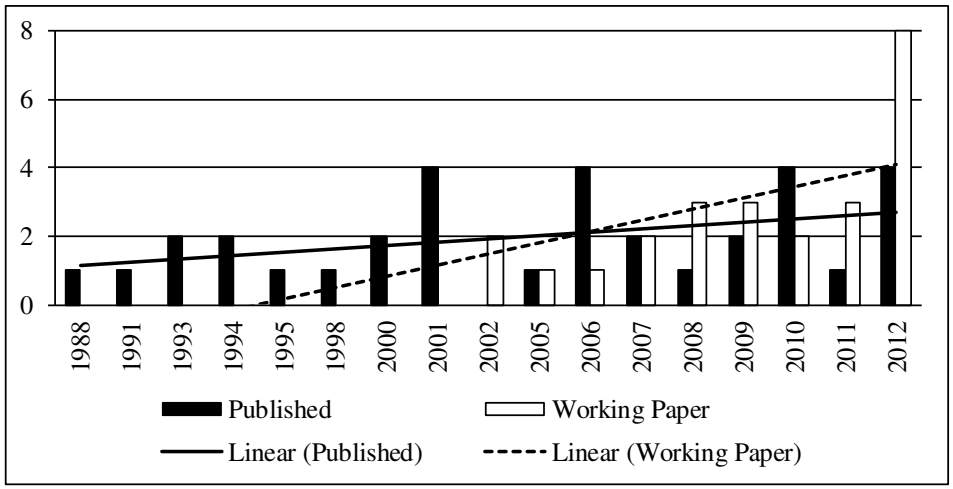

Figure 1. Number of published studies and working papers in the SSW literature.
The figure shows, separately, the number of published studies and working papers in the SSW literature since 1988. The lines indicate linear trends.

In the present article, we collect the quantitative results from 33 published articles and 25 working papers and aggregate them in a unified database. While early studies used mainly anecdotal evidence to support their conclusions, later work employed methods of statistical and quantitative analysis. We therefore hope that this database will provide researchers active in this area with a reference resource. Note that, in contrast to other designs in the experimental economics literature, SSW-type markets do not have a clear benchmark to compare their results to, like a rational expectations equilibrium or a Nash equilibrium. Even a no-trade theorem requires some auxiliary assumptions to hold in such a market.[2] For this reason, researchers have resorted to measures specifically designed for SSW -type environments to describe the size of bubbles in financial market prices. We have collected these measure observations and have additionally calculated all missing measures which can be derived based on the data provided in the set of studies surveyed in this article. The database assembled in this way contains close to 1600 individual bubble measure observations. In addition to serving as the source of several summary statistics reported below, it is freely available online from the online repository located at http://academic.palan.biz/downloads/bubblemeasuredb.[3]

This article's contribution thus is twofold: The first is that it contains the first homogenized listing of the definitions and descriptions of the bubble measures most frequently used in this literature. The second is the database of bubble measure results,

[2] For a discussion of equilibria in SSW-type markets see Palan (2009, 26–33).
[3] Researchers using the database are asked to make reference to this article in their work.

which is intended to serve as a unique quantitative resource for future research in this area.

The study is structured as follows: Section 1 describes the baseline market introduced by SSW. It also contains a description of the price patterns typically observed in this type of market. Section 2 contains a listing and description of the different bubble measures contained in the bubble measure database and referred to throughout the article. Section 3 concludes the paper. Finally, the Appendix contains information on and quantitative results from the bubble measure database mentioned above.

1. Description of the Baseline Market

1.1. Market Design

SSW introduced an experimental asset market which has since formed the basis of numerous replications and manipulations. Before discussing deviations from their canonical design,[4] we will define what we will refer to as a baseline market, which will serve as the point of departure for the identification of treatment manipulations later on.

A baseline market is populated by student subjects who can both buy and sell over fifteen periods in a single closed book double auction market. A period usually lasts between four and six minutes in real time and all subjects have participated in the same number of previous markets of this type. The asset being traded may not be sold short or bought on margin. It pays a random, discretely and uniformly distributed, four-point, positively skewed dividend with positive expected value after each period and has no terminal value. This implies that the asset's fundamental value declines monotonically, following the equation $V_t = (T - t + 1) \cdot \mathrm{E}[d]$, where T is the total number of periods, t is the current period, $\mathrm{E}[\cdot]$ is the expectations operator and d is the dividend per unit of the asset. In each period, the dividend is the same for each unit of the asset and for each subject owning an asset, and dividend income is added to subjects' cash inventories immediately (i.e. it is available to fund asset purchases in the period following the dividend payout). Subjects are informed about this dividend process, but learn the specific outcome of a period's dividend draw only after the period. Subjects are furthermore aware of who is in the experiment with them (i.e. they are in the same room with the other subjects), but they are not informed about other subjects' endowments and can neither communicate with each other nor connect orders in the market to the person originating them.

There are no explicit transaction costs, no interest on money holdings and no circuit breakers in the market. Subjects are rewarded for their participation through monetary compensation. The amount they receive is calculated by multiplying their final cash

[4] The market structure which has most frequently been employed as the point of departure for subsequent studies is design 4 of SSW.

position by an exchange rate in order to convert it from experimental to real currency units. A fixed show-up fee may be added to the variable compensation from the experiment. The expected payoff is greater than or equal to the normal hourly wage for typical student jobs in the area where the experiment is being conducted.

1.2. Typical Price and Volume Patterns

Prices in baseline markets with inexperienced subjects typically start out below fundamental value (calculated as the sum of all expected future dividends), appreciate to the fundamental value by periods 2 to 4, then go on to form a bubble above it, and finally crash back down to fundamental value in periods 10 to 15. This pattern is depicted in Figure 2. Note that, while individual markets in this literature are generally characterized by large heterogeneity, the majority of baseline markets with inexperienced subjects follow this pattern.

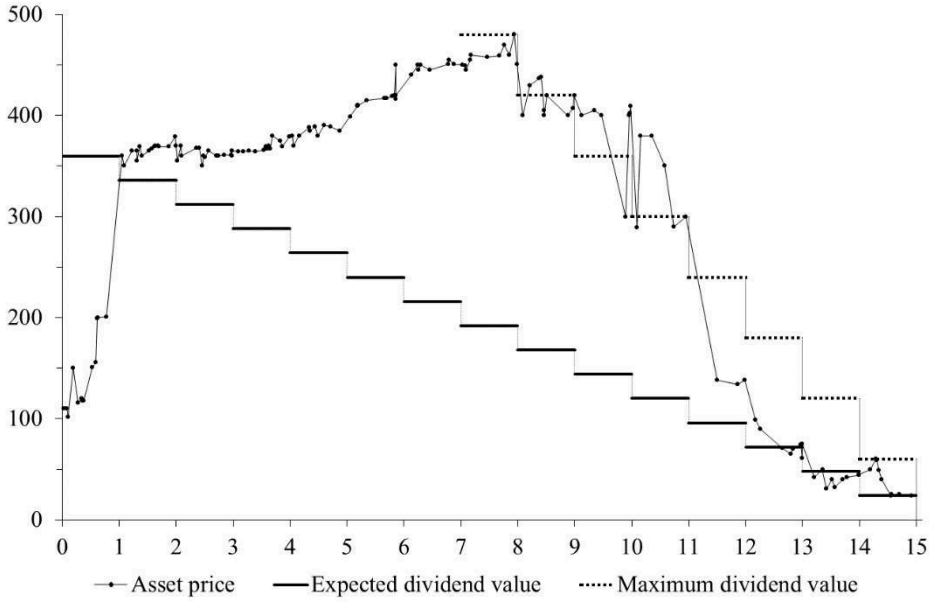

Figure 2. Typical price pattern in baseline markets with inexperienced subjects.

The lower (upper) step-wise decreasing function shows the expected (maximum) dividend return from holding one unit of the asset from the respective period until the end of the experiment.

2. Definition of Bubble Measure Types

A plethora of measures of the extent and severity of the observed bubble has been proposed, but only some have been taken up and become widely accepted. We name the measures reported below using the initials of the authors of the papers they were first employed in. Aiming to present the measures in as simple a way as possible, we

employ the same symbols for the same underlying variables, regardless of the symbols used in the original papers. Furthermore, we try to homogenize the presentation of the measures by bringing similar specifications into a similar format where possible. Finally, where reporting actual measure values, we rescale measures to make them comparable to measurements taken in baseline markets, in particular by adjusting for numbers of periods different from 15.[5]

We hope that this structured presentation of the information contained in previous experimental studies will help future researchers in more readily discussing their observations before the background of these results. The actual bubble measure observations are reported in the Appendix in order to limit the article's bulk and improve its readability. Researchers interested in the detailed measurement results are however referred to the bubble measure database itself, which we intend to update even after publication of this article.

2.1. Amplitude Measures

Amplitude measures generally report the difference between the lowest and highest mean period price in an experimental session, which may then be normalized using some form of fundamental value. Haruvy and Noussair (2006) employ the following measure:

$$AmplitudeHN = \max\left(\frac{\overline{P}_t - f_t}{f_t}\right) - \min\left(\frac{\overline{P}_t - f_t}{f_t}\right), \tag{1}$$

where $\overline{P}_t$ is the mean transaction price in the market in period t, and f_t is the fundamental or dividend holding value in the same period.

King (1991) uses the following measure:

$$AmplitudeK = \max\left(\frac{\overline{P}_t - f_t}{f_1}\right) - \min\left(\frac{\overline{P}_t - f_t}{f_1}\right). \tag{2}$$

As a final amplitude measure, van Boening, Williams and LaMaster (1993) report values calculated according to the following equation:

$$AmplitudeVWL = \max\left(\overline{P}_t - f_t\right) - \min\left(\overline{P}_t - f_t\right). \tag{3}$$

Clearly, the results of equation (3) are isomorphic to those from equation (2) and each can easily calculated from the other as long as the asset's fundamental value in the first period is reported. Since specification (2) seems to have become the norm for

[5] The following measures are adjusted for period numbers other than 15 by multiplying the measure result by $15/T$: DeviationKSWV, ExtremeOverpricingAC, DurationK, DurationPS, PositiveDurationACCD, BoomDurationHN, BustDurationHN and TurnoverK. This is also the reason for our definition of ExtremeUnderpricing containing this factor. Note that this normalization by dividing the measure result by the number of periods and multiplying with the most commonly chosen number of periods, fifteen, cannot be expected to capture all effects the decreased or increased number of periods has on measure results. Nonetheless we believe it to be the best general approximation for unbiased results in treatments with a period number other than 15.

papers later than 1993, we report results calculated using equation (3) as transformed into the equation (2) version.

2.2. Deviation Measures

Haruvy and Noussair (2006) use a measure that provides information about the average strength and direction of the price deviation from fundamental value. A positive (negative) value indicates that median period prices on average exceed (fall short of) the fundamental value, while outcomes close to zero are characteristic of median prices that closely track the fundamental value process. The measure is calculated as:

$$AverageBiasHN = \frac{\sum_{t=1}^{T}(\tilde{P}_t - f_t)}{T},$$

where $\tilde{P}_t$ is the median transaction price in period t.

King et al. (1993) and van Boening, Williams and LaMaster (1993) calculate a measure of normalized absolute price deviation which sums the deviation of the asset price from the fundamental value for every transaction in every period and normalizes it by dividing by the total number of assets outstanding:

$$DeviationKSWV = \frac{\sum_{t=1}^{T}\sum_{i_t=1}^{I_t}|P_{i_t} - f_t|}{q}, \tag{4}$$

where P_{i_t} is the transaction price of transaction i in period t, I_t is the total number of transaction in period t, and q is the total number of assets outstanding in the experiment, sometimes also referred to as the total stock of units, TSU. In this calculation, they use prices quoted in U.S. dollars.[6]

Following Lei, Noussair and Plott (2001) and Ackert et al. (2006), who report information on the number of transactions conducted at prices above (below) the maximum (minimum) possible remaining dividend payoff of the asset over the remaining time in the experimental session, Palan (2009) defines the following measures:

$$OverpricedTransactionsP = \frac{\sum_{t=1}^{T}\sum_{i_t=1}^{I_t} x_{i_t}^{max}}{q^s}, \tag{5}$$

where $x_{i_t}^{max} = \begin{cases} 0 & \text{if } P_{i_t} \le f_t^{max} \\ 1 & \text{if } P_{i_t} > f_t^{max} \end{cases}$, and

$$UnderpricedTransactionsP = \frac{\sum_{t=1}^{T}\sum_{i_t=1}^{I_t} x_{i_t}^{min}}{q^s}, \tag{6}$$

where $x_{i_t}^{min} = \begin{cases} 0 & \text{if } P_{i_t} \ge f_t^{min} \\ 1 & \text{if } P_{i_t} < f_t^{min}. \end{cases}$

[6] Later studies, e.g. Haruvy and Noussair (2006), usually quote prices in cents or a similarly scaled experimental currency. They then calculate an equivalent or comparable measure as follows: $\left(\sum_{t=1}^{T}\sum_{i_t=1}^{I_t}|P_{i_t} - f_t|\right)/(100 \cdot q)$.

For both, q^s is the total number of transactions in the experimental session, and f_t^{max} (f_t^{min}) is the maximum (minimum) possible remaining dividend payoff from one unit of the asset from period t until the end of the session. In the Lei, Noussair and Plott (2001) setting, these measures provide clear evidence of irrationality, because capitalizing on capital gains is ruled out in their setting. While this is not the case in most articles in our database, Harrison and Kreps (1978) assert that – even when capital gains are possible – investors can be said to exhibit speculative behavior if they are willing to pay more for a stock with the right to resell it than if they were obliged to hold it forever. We follow this argument and present results for these two measures also for studies that – contrary to Lei, Noussair and Plott (2001) – allow for speculation.

Ackert and Church (2001) define a rather similar measure of the number of periods in which the mean period price exceeds the maximum remaining dividend payoff from one unit of the asset from period t until the end of the session as follows:

$$ExtremeOverpricingAC = \sum_{t=1}^{T} x_t^{over}, \tag{7}$$

$$\text{where } x_t^{over} = \begin{cases} 0 & \text{if } \overline{P}_t \le f_t^{max} \\ 1 & \text{if } \overline{P}_t > f_t^{max} \end{cases}.$$

Note that the Ackert and Church (2001) experiments uniformly comprised 15 periods. In order to make their measure more easily comparable over treatments with different numbers of periods, we propose the following modified form:

$$ExtremeOverpricing = \frac{15}{T} \cdot \sum_{t=1}^{T} x_{i,t}^{over}. \tag{8}$$

An analogous measure for underpricing would be:

$$ExtremeUnderpricing = \frac{15}{T} \cdot \sum_{t=1}^{T} x_t^{under}, \tag{9}$$

$$\text{where } x_t^{under} = \begin{cases} 0 & \text{if } \overline{P}_t \le f_t^{max} \\ 1 & \text{if } \overline{P}_t > f_t^{max} \end{cases}.$$

The difference between measures (5) and (8) and between (6) and (9) is that (5) and (6) measure prices for individual transactions, while (8) and (9) consider them at the mean period price level.

2.3. Duration Measures

King (1991) reports a boom duration measure, defined as the "Number of periods from low to high mean price", where the mean price is defined as "Mean contract price (measured as difference from expected price) […]", which subsequent articles have interpret to mean (in its normalized form):

$$DurationK = \left| \arg\max_t \left(\overline{P}_t - f_t \right) - \arg\min_t \left(\overline{P}_t - f_t \right) \right|. \tag{10}$$

Porter and Smith (1995) also calculate a measure for the temporal length of the price bubble, which can be written as:

$$DurationPS = \max_{t,m}\left(m: \overline{P}_t - f_t < \overline{P}_{t+1} - f_{t+1} < \cdots < \overline{P}_{t+m} - f_{t+m}\right). \quad (11)$$

This equation defines the duration of a bubble as the length of the longest uninterrupted interval during which the deviation of mean period prices from period fundamental values increases.

In their Positive duration, Ackert et al. (2006) modify DurationPS as follows:

$$PositiveDurationACCD = \max_{t,m}\left(m: \overline{P}_t - f_t < \overline{P}_{t+1} - f_{t+1} < \cdots < \overline{P}_{t+m} - f_{t+m}\right),$$

$$\text{s.t. } \overline{P}_{t+1} - f_{t+1} > 0. \quad (12)$$

Positive duration thus is the number of consecutive periods with price increases relative to fundamental value, subject to the constraint that the increase produces a price exceeding fundamental value.

Finally, Haruvy and Noussair (2006) use two measures to describe the length of contiguous time intervals in which prices exceed (fall short of) the fundamental value. The first, BoomDurationHN thus measures the length of intervals where prices are above fundamental value:

$$BoomDurationHN = \left(\max_{t,m}\left(m: \tilde{P}_t > f_t, \tilde{P}_{t+1} > f_{t+1}, \ldots, \tilde{P}_{t+m} > f_{t+m}\right) + 1\right),$$

if there is a period with median price exceeding fundamental value (otherwise $BoomDurationHN = 0$).

Similarly, BustDurationHN is used to describe intervals of what they call "negative bubbles", i.e. where prices fall short of the fundamental value:

$$BustDurationHN = \left(\max_{t,m}\left(m: \tilde{P}_t < f_t, \tilde{P}_{t+1} < f_{t+1}, \ldots, \tilde{P}_{t+m} < f_{t+m}\right) + 1\right),$$

if there is a period with median price below fundamental value (otherwise $BustDurationHN = 0$).

2.4. Turnover Measure

King (1991) measures the turnover by calculating a measure comprised of the total quantity of assets exchanged over the course of the experiment divided by the number of assets outstanding:

$$TurnoverK = \sum_{t=1}^{T} \frac{q_t}{q}, \quad (13)$$

where q_t is the number of transactions in period t. The interpretation of the turnover in most of the markets in the literature is ambiguous. Due to the symmetric information structure, no-trade theorems apply for the case where all traders are risk-neutral. While trade would be expected to occur if subjects are rational and heterogeneous with regard to their risk attitude, assets would only be expected to move from more to less risk-averse individuals. However, in most experiments assets tend to move back and forth between subjects, and change hands repeatedly over the course of the experiment; a fact that suggests that high turnover is indicative of an inefficient market. Smith, van Boening and Wellford (2000) provide an alternative view, noting that if large numbers of trades occur around intrinsic value, traders might infer that the market is highly competitive, which would inhibit price bubbles.

2.5. Dispersion Measures

Palan (2009) proposes a measure for the volatility of market prices which is calculated as follows:

$$DispersionRatioP = \frac{1}{T} \cdot \sum_{t=1}^{T} \frac{\hat{\sigma}_{P_{i_t}}}{\sigma_{f_t}}, \tag{14}$$

where $\hat{\sigma}_{P_{i_t}}$ is the sample standard deviation of transaction prices in period t, and σ_{f_t} is the standard deviation from the theoretical distribution of the ex-post fundamental value of the asset in period t.[7] DispersionRatioP thus measures the mean transaction price volatility relative to the volatility of the asset's fundamental value. A value of unity signifies that transaction prices in the experiment are on average exactly as volatile as the ex-post fundamental value of the asset, with values smaller (larger) than unity signifying transaction prices that are less (more) volatile than this benchmark.

Haruvy and Noussair (2006) report a measure for the aggregated absolute deviation of median period prices from fundamental value called "Total Dispersion". We will employ a slightly modified version in that we normalize over the total number of periods to obtain a measure comparable to *AverageBiasHN*:

$$AverageDispersion = \frac{\sum_{t=1}^{T} |\tilde{P}_t - f_t|}{T}.$$

Values close to zero are characteristic of median prices that closely track the fundamental value process, while positive values indicate prices deviating from the fundamental value.

Finally, King et al. (1993) propose using the simple variance of transaction prices, since this is the dispersion measure most commonly applied to markets outside the

[7] In standard SSW experiments with 15-periods, possible (independent) dividend payments of 0, 8, 28, or 60 cents, and no terminal value, this is $\sqrt{(16-t) \cdot 0.25 \cdot [(0-24)^2 + (8-24)^2 + (28-24)^2 + (60-24)^2]}$ in period t.

laboratory. This is certainly a valid argument and the variance has the additional advantage over other measures proposed above that it does not require information on the fundamental value which, outside the laboratory, is usually unobservable. Nonetheless, the variance has not been adopted by the SSW literature and is therefore listed here for completeness' sake only:

$$VarianceKSWV = \frac{1}{\sum_{t=1}^{T}(I_t)+1} \cdot \sum_{t=1}^{T} \sum_{i_t=1}^{I_t} \left(P_{i_t} - \overline{P}_{i_t}\right)^2,$$

The definition of VarianceKSWV concludes the presentation of the bubble measures employed in the discussion below and contained in the bubble measure database.

3. Description of the database

3.1. Structure of the dataset

The dataset comprises 1585 individual bubble measure observations, stemming from 33 published and 25 unpublished papers. Each such observation consists of the following elements (where available): The name of the original study the bubble measure was reported in,[8] the measure type, the value of the measure, subjects' experience level (i.e. the number of times subjects have participated in the same type of market), the sample size the bubble measure observation is based on,[9] the asset-to-cash ratio, the number of periods in the experimental market, the period length in seconds, the treatment manipulations differing from the design of a baseline market, and parameters specific to the observation (e.g. that the measure observation was rescaled to be comparable to measure observations obtained under the baseline design, or that the measure is the result of a seemingly unrelated regression instead of direct calculation). Furthermore, each record contains information on where in the original study the bubble measure was reported or where the data it is based on can be found. In addition to this, if the original study reports a statistical test of the value of a measure being significantly different from one treatment design to another, the respective measures are linked in the database to include this information. Figure 3 shows an example screenshot of the bubble measure entry screen. The treatment manipulations and the additional parameters will be described in more detail below.

[8] Many of the bubble measure observations in the dataset are not taken directly from reported bubble measure values in the original study, but were calculated by us based on data reported in the original study.

[9] Note that many reported bubble measure values are means over several experimental markets, run with the same design. Sample size in this context refers to the number of individual markets a given bubble measure observation is based on.

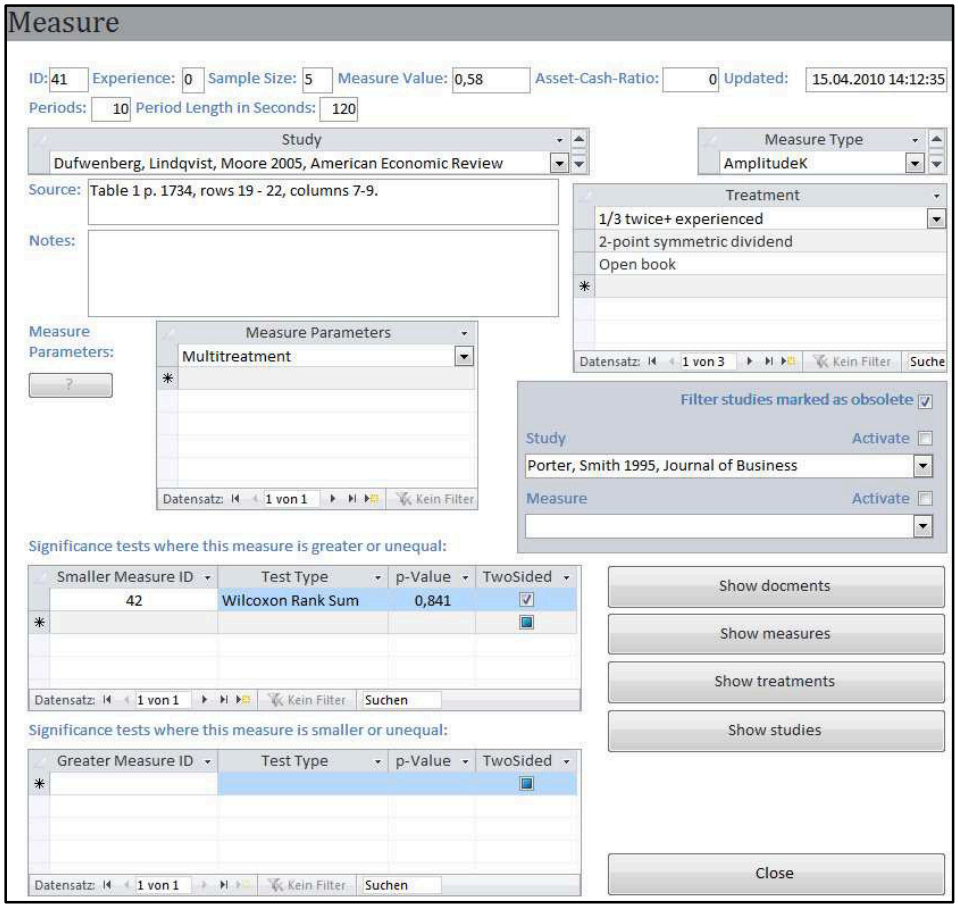

Figure 3. Screenshot of the bubble measure entry form.

The figure shows a screen shot of the database's bubble measure entry form. It contains: the name of the original study the bubble measure was reported in; the measure type; the value of the measure; subjects' experience level; the sample size the bubble measure observation is based on; the asset-to-cash ratio; the number of periods in the experimental market; the period length in seconds; the treatment manipulations differing from the design of a baseline market; parameters specific to the observation; where in the original study the bubble measure was reported or where the data it is based on can be found; and a link to the comparison measure observation if the original study reports a statistical test of treatment differences between measure observations.

3.2. Definition of treatments

We consider a variation from the baseline described in section 1.1 to be a treatment manipulation, which we will refer to simply as a "treatment". If for example a market allows margin buying, we would list a bubble measure obtained from this market as obtained under the "Margin buying" treatment. Appendix table A.1 provides a list of

the treatments together with a short description and the associated research hypothesis.[10] Following this rule, a bubble measure observation may stem from a market that belongs to more than one treatment. We will refer to the totality of all treatment variations an observation was obtained under (i.e. the totality of all variations in market design from the baseline) as the "treatment combination". In the screenshot provided in Figure 3, the treatment combination can be seen in the box titled "Treatment", consisting of the three treatments "1/3 twice+ experienced", "2-point symmetric dividend" and "Open book".

3.3. Measure results

While listing all the information in the database in this paper would be impractical, we provide summary data in the appendix tables A.2, A.3 and A.4. The first contains an overview of the number of bubble measure observations in the database, aggregated by study and measure type. Tables A.3 and A.4 report mean measure values, aggregated by treatment and measure type. Note that Table A.3 (A.4) includes (excludes) bubble measure observations from markets which differ in more than one treatment variation from the baseline market, as defined in section 1.1 of this paper. For this reason, Table A.3 contains relatively few missing values, yet should be interpreted with caution, since the mean values reported may be biased due to the influence of other treatment variations. Table A.4, conversely, contains "pure" observations of the treatments listed, but suffers from many missing values.

4. Conclusion

Despite the fact that a number of criticisms have been directed at the market design (e.g. against the declining fundamental value, the deterministic length of the market, or the perfect knowledge about the asset's expected value), it is the best-documented experimental asset market design in existence and thus offers a superior base of comparison for new work. Furthermore, these shortcomings have in turn sparked studies studying their impact on the observed results as well as work proposing and analyzing new market structures free of these perceived problems. The wealth of findings and the continued activity and interest in this field, as evidenced by the considerable number of working papers and recently published studies, indicates that the line of re-

[10] In experimental studies, no two experiments follow exactly the same institution. For this reason, results we designate as stemming from e.g. a Baseline treatment might have been run with a different subject base, might employ slightly different dividend distributions, have different instructions and be conducted on a different software platform from previous studies. Since such differences are inevitable when viewing experimental work from a high-level perspective, we intentionally sacrifice detail to gain homogeneity of presentation.

search started by SSW will continue to advance the discipline's understanding of traders' behavior in multi-period asset markets in the future.[11] We hope to contribute to this work through our database of all the bubble measures in the existing literature. By granting open access to our data, we hope to provide colleagues with a tool that they find useful and can use at their leisure and in the way that best profits their own research.

This paper is intended to serve as a reference resource to the bubble measure database. The database itself, as well as supporting material, can be downloaded from the online repository at http://academic.palan.biz/downloads/bubblemeasuredb. The supporting material consists of a reference sheet of bubble measure definitions, a video introduction to working with the database, and a spreadsheet containing the calculations which yielded the bubble measures contained in the database. Furthermore, the repository contains both the version of these files published together with this article, and any updated versions which we may have created since. Comments and feedback are welcome.

[11] Another sign of the community's perception of the relevance this literature is that asset market experiments following the SSW design have by now also found their way into economics teaching programs, cp. Williams and Walker (1993), Ball and Holt (1998) and Bostian and Holt (2009).

Appendix

Table A.1 Treatments and Hypotheses

This table lists the general treatment designs employed in studies on the performance of SSW markets in the literature. The treatments are listed with a designation assigned by us, with a short description of the experimental institution employed, and with the hypothesis this treatment is designed to test.

Treatment	Description	Hypothesis
1/3 twice+ experienced	1/3 of the traders are at least twice experienced, 2/3 are inexperienced	Small fraction of experienced traders prevents bubble
2/3 twice+ experienced	2/3 of the traders are at least twice experienced, 1/3 are inexperienced	Large fraction of experienced traders prevents bubble
2-point symmetric dividend	Two-point discrete dividend distribution with symmetric probabilities	Symmetric dividend focuses attention on expected value
3-point symmetric dividend	Three-point discrete dividend distribution with symmetric probabilities	Symmetric dividend focuses attention on expected value
5-point symmetric dividend	Five-point discrete dividend distribution with symmetric probabilities	Symmetric dividend focuses attention on expected value
Announcement high, preset	Uninformative announcement telling subjects that "The price is too high", chosen by experimenter prior to session	Uninformative communication influences bubble characteristics; experimenter choice prior to session conveys medium reliability
Announcement high, random	Uninformative announcement telling subjects that "The price is too high"; randomly chosen prior to session	Uninformative communication influences bubble characteristics ; random choice prior to session conveys low reliability
Announcement low, preset	Uninformative announcement telling subjects that "The price is too low", chosen by experimenter prior to session	Uninformative communication influences bubble characteristics; experimenter choice prior to session conveys medium reliability
Announcement low, random	Uninformative announcement telling subjects that "The price is too low"; randomly chosen prior to session	Uninformative communication influences bubble characteristics ; random choice prior to session conveys low reliability
Announcement true	Uninformative announcement telling subjects that "The price is too high/low"; announcement is always true, conditional on previous period's price	Informative communication influences bubble characteristics; conditional choice based on actual prices conveys high reliability

Treatment	Description	Hypothesis
Baseline	(Smith, Suchanek and Williams, 1988) baseline design	Rational expectations equilibrium causes trading at fundamental values
Bonus after market	The three subjects with the highest profit receive extra cash after a market	Tournament compensation exacerbates bubbles
Bonus after period	The three subjects with the highest profit receive extra cash after a period	Tournament compensation exacerbates bubbles
Brokerage fees	Buyer and seller in a transaction pay 10 cents each for a trade	Fewer transactions due to cost of trading
Call auction	Call auction instead of double auction	Less public information decreases bubbles by decreasing speculation
Capital gains tax	Tax of 50% levied on all intra-period changes in cash	Tax reduces incentive for speculation
Cash inflows	Subjects receive cash inflows to offset changes in the cash-asset ratio	Cash-asset ratio is responsible for bubble phenomenon
Cash outflows	Subjects suffer cash outflows to offset changes in the cash-asset ratio	Cash-asset ratio is responsible for bubble phenomenon
Chat	Subjects can freely converse via electronic chat while trading	Communication may affect mispricing
Comparison private 0% upward	0% (100%) of all subjects get private information on highest (lowest) wealth of any subject	Social comparison impacts bubble characteristics
Comparison private 100% upward	100% (0%) of all subjects get private information on highest (lowest) wealth of any subject	Social comparison impacts bubble characteristics
Comparison private 33% upward	33% (67%) of all subjects get private information on highest (lowest) wealth of any subject	Social comparison impacts bubble characteristics
Comparison private 67% upward	67% (33%) of all subjects get private information on highest (lowest) wealth of any subject	Social comparison impacts bubble characteristics
Comparison public downward	Public information on lowest wealth of any subject	Social comparison impacts bubble characteristics
Comparison public upward	Public information on highest wealth of any subject	Social comparison impacts bubble characteristics
Constant value	Security pays a dividend with a mean of zero at the end of each period	Constant fundamental value decreases bubbles due to simplified convergence process

Treatment	Description	Hypothesis
Digital options 5/10/15	Subjects can trade in digital options market maturing in periods 5, 10, and 15	Digital option contracts should hasten the formation of common expectations
Digital options 8	Subjects can trade in digital options market maturing in period 8	Digital option contracts should hasten the formation of common expectations
Dividend account	Dividends are paid into separate account and are not available to fund purchases	Cash-asset ratio is responsible for bubble phenomenon
Dividend certainty	Security pays a fixed and known dividend amount	Trading based on dividend risk preference is eliminated
Dividend deferred	Subjects are entitled to a dividend, but payout is deferred until the end of the experimental round	Deferred dividend payment reduces liquidity, thereby deflating transaction prices
Dividend heterogeneity	Dividend level different across investors	Heterogeneous dividends increase propensity to trade and permit measurement of allocational efficiency
Dividend mix	Security pays dividends at the end of each period and an additional dividend at the end of the trading horizon	Dividend concentration focuses attention on longer-term income stream
Dividend once	Security pays a single dividend at the end of the trading horizon	Dividend concentration focuses attention on longer-term income stream
Dividend spread high	Security pays a period-end dividend of {0,1,8,28,98} with equal probability	Higher dividend variability compared to Baseline treatment increases bubble extent
Emotion elicitation	Elicitation of excitement, anger, anxiety and joy at the beginning of every period	Mispricing is affected by subjects' emotional state
Equal endowments	Homogeneous initial amounts of cash and assets over all traders	Traders do not need to balance portfolios
Equal inflows	Traders receive equal periodic cash and asset inflows.	League-table incentives exacerbate bubbles.
Experienced business	Half of all traders are (mainly) twice experienced business majors, half are inexperienced arts and sciences students	Business and economics education improves market efficiency

Treatment	Description	Hypothesis
Experienced non-business	Half of all traders are inexperienced business majors, half are (mainly) twice experienced arts and sciences students	Business and economics education improves market efficiency
Extensive control questions	Subjects have to answer a question about the asset's dividend holding value for every period and the buying and selling frame.	Extended control questions induce common knowledge of rationality and fundamental value trading
Fundamental value forecast	Subjects have to forecast the period's fundamental value at the beginning of every period	Reducing subject confusion about the fundamental value reduces bubbles
Fundamental value graph	In the instructions, the fundamental value is illustrated by a graph instead of a table	Reducing subject confusion about the fundamental value reduces bubbles
Futures	Agents can trade a mid-horizon (period 8) security in advance	Futures contracts should hasten the formation of common expectations
Gold mine framing	Asset is framed as a "depletable gold mine"	Framing reduces subject confusion
High skewness truncated	Asset with highly skewed, truncated value distribution	Subjects exhibit probability judgment error compared to untruncated asset
High skewness untruncated	Asset with highly skewed, untruncated value distribution	Subjects exhibit probability judgment error compared to truncated asset
Increasing value	Security has a terminal value and, becaue of a negative expected dividend or high interest on cash, has an increasing fundamental value	Increasing fundamental value leads to bubble amelioration
Inflow 1/3	Inflow of inexperienced traders every period, amounting to 1/3 of all traders	Inexperienced players exacerbate bubbles
Inflow 2/3	Inflow of inexperienced traders every period, amounting to 2/3 of all traders	Inexperienced players exacerbate bubbles
Informed insiders	Informed traders have read (Smith, Suchanek and Williams, 1988) and are given information on bids, offers and excess bids	Informed traders aware of bubble characteristics eliminate bubble
Interest rate 10%	Market interest rate of 10% on cash holdings	Opportunity cost of holding cash lowers asset price
Interest rate 15%	Market interest rate of 15% on cash holdings	Opportunity cost of holding cash lowers asset price

Treatment	Description	Hypothesis
Interest rate 20%	Market interest rate of 20% on cash holdings	Opportunity cost of holding cash lowers asset price
Interest rate 5%	Market interest rate of 5% on investments in risk-less bond	Opportunity cost of investment in interest bearing bond lowers asset price
Interest rate policy	Market interest on investments in risk-less bond, increases when market overheats	Opportunity cost of investment in interest bearing bond lowers asset price
Limit price change rule	Asset price can only change by a limited amount from the previous period closing price	Suppressed expectation of rapid price changes reduces price volatility
Lottery asset	Measure is for an asset with a high dividend with low probability, which accompanies the standard market	Lottery assets exhibit higher extent and frequency of bubbles
Margin buying	Traders are given an interest-free loan to be paid back by the last period	Purchases can be leveraged to raise prices that are below dividend value
No common knowledge	Subjects are unsure how many of the subjects in their market answered extended control questions	Common knowledge of rationality, induced by extended control questions, induces fundamental value trading
No speculation	Traders are either buyers or sellers, but never both	Impossibility of reaping capital gains prevents speculative bubble
Non-business	Traders are freshman arts and sciences students	Business and economics education improves market efficiency
Open book	All orders are visible to all participants	Information diminishes bubble size
Oral	Market transactions are conducted orally	0
Overconfident	Subjects obtained high scores on overconfidence test.	Overconfidence causes bubbles.
Partial information	Traders can buy information about dividend values in each period of a five-period sequence, delivered at the beginning of the sequence	Private information reinforces common expectations and weakens reliance on information in prices
Peak	Traders experience a time of rising, followed by a time of falling fundamental values	Bubbles are path-dependent
Valley	Traders experience a time of falling, followed by a time of rising fundamental values	Bubbles are path-dependent

Table A.2 Bubble Measure Observations per Study and Measures

This table lists the number of bubble measure datasets by study and measure type.

Study	AmplitudeK	AmplitudeHN	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	UnderpricedTransactions	VarianceKSWV
(Ackert et al., 2006)					6	6							3	6	6	3	
(Ackert et al., 2009)	2	2	2	2	2	2			2	2	2			2			
(Ackert and Church, 2001)	7				7	7				7	7				7		
(Ackert, Kluger and Qi, 2012)	1	1	1	1	1	1			1	1	1			1	1		
(Bostian, Goeree and Holt, 2005, August 30)					2	2											
(Caginalp, Porter and Smith, 1998)	4	4	4	4	4	4			4	4	4	4		4			
(Caginalp, Porter and Smith, 2001)	16	16	16	16	16	16			16	16	16	9		16			
(Cheung and Coleman, 2011)		8	8	8			8			8					8		
(Cheung, Hedegaard and Palan, 2012)	5	5	5	5	5	5	5	5	5	5	5		5	5	5		5
(Cheung and Palan, 2012)	7	7	7	7	7	7	7	7	7	7	7		7	7	7		1
(Corgnet, Kujal and Porter, 2010)	12			12	4	4	12			12					12		
(Davies, 2006, August 18)	6	6	6	6	6	6			6	6	6	6		6	6		
(Dufwenberg, Lindqvist and Moore, 2005)	5						5								5		
(Fisher and Kelly, 2000)					5	5				5				5			
(Giusti, Jiang and Xu, 2012, March 12)															4		
(Hargreaves Heap and Zizzo, 2012, March)				8											8		
(Haruvy, Lahav and Noussair, 2007)		4	4	4	4		4								4		
(Haruvy and Noussair, 2006)		10	10	10	10	10	10								10		
(Huber and Kirchler, 2012)			3	3													
(Hussam, Porter and Smith, 2008)	6				5	5				6	5			5	6		
(King, 1991)	6				3	3			6						6		
(King et al., 1993)	20						20		20						20		20
(Kirchler, Huber and Stöckl, 2012)	7		7	7											7		
(Lei, Noussair and Plott, 2001)					9	9							3		9	3	

Study	AmplitudeK	AmplitudeHN	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	UnderpricedTransactions	VarianceKSWV
(Lei, Noussair and Plott, 2002, June)	1				1	1	1								1		
(Lei and Vesely, 2009)	1				1	1	1				1	1			1		
(Levine and Zajac, 2007, June 20)	2			2													
(Lugovskyy, Puzzello and Tucker, 2010, March)	1				1	1	1								1		
(Michailova, 2011)	2				2	2	2								2		
(Noussair and Powell, 2010)		12	12	12	12	12	12								12		
(Xie and Zhang, 2012, January)	12	12		12			12								12		

Table A.3 Mean Bubble Measure Value by Treatment and Measure Type, Inexperienced Subjects

This table reports the mean measure value by treatment and measure type.

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	UnderpricedTransactions	VarianceKSWV	AmplitudeHN
1/3 twice+ experienced	0.58					1.891								8.412			
2/3 twice+ experienced	0.684		146.4			0.704								3.562			1.313
2-point symmetric dividend	0.937	0.936	120.998	9.258	3.703	1.625				0.5	3.75	0.36		2.982	0.103		2.808
3-point symmetric dividend	0.503	-17.69	34.598	5.719	6.531	3.965		6.656	4.244	0.218	1.91		1.487	6.007		0.568	0.438

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	UnderpricedTransactions	VarianceKSWV	AmplitudeHN
5-point symmetric dividend	1.118			10	3	1.989								5.052			
Announcement high, preset	0.98		58.51			4.31			5.67					4.14			
Announcement high, random	1.17		115.8			10.7			11.67					7.728			
Announcement low, preset	1.3		128.75			6.6			10.67					4.31			
Announcement low, random	1.14		112.5			9.56			11.33					7.728			
Announcement true	1.07		105.19			8.44			8.33					5.07			
Baseline	0.995	102.7	130.495	12.833	1.889	8.553		7.55	5.058	4	0		3.667	6.12		1.106	2.909
Bonus after market		8.952	28.614			1.214								3.004			0.701
Bonus after period		17.552	72.078			3.524								3.783			2.01
Brokerage fees	0.466					3.91		10	10					5.555		0.526	
Call auction	1.015	-2.461	147.898	6.624	5.823	0.919	1.007	7.838	6.117	1.029	1.91	0.08	2.816	2.038			2.514
Capital gains tax	1.586			7.083	5.833	7.665								3.556			
Cash inflows	0.173	-2.78	3.818											2.318			
Cash outflows	0.416	-0.85	9.302											1.435			
Chat			101.21											10.408			
Comparison private 0% upward				7.2	7.2												
Comparison private 100% upward				9.8	5.2												
Comparison private 33% upward				8.5	6												
Comparison private 67% upward				7.1	6												
Comparison public downward		-3.6	72.393	7.3	4.286									9			4.4
Comparison public upward		105.1	145.533	11.4	3									9.9			6.5
Constant value	0.333	-5.012	40.21	8.307	3.454	2.74	0.744	8.085	3.626	0.152	1.955		2.082	4.686		0.303	0.284

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	UnderpricedTransactions	VarianceKSWV	AmplitudeHN
Digital options 5/10/15	1.572	133.16	178.533	11.333	3.333	8.343	0.551	11	11	5		0.244	8.667	7.331		1.893	6.972
Digital options 8	1.248	158.3	171.967	13.5	0.75	11.692	0.319	8	10.667	4.5		0.28	10.75	6.417		1.33	5.687
Dividend account	0.227	-0.96	5.297											1.764			
Dividend certainty	0.862	17.172	28.654	6.75	2.916	0.379	0.289	6	6.666	0.333		0.008	2.167	4.804		2.091	7.167
Dividend deferred	1.02	-45.4	118.833	8.609	3.22			11.917	9.708	0.5		0.36	3.75	1.246	0.103		3.618
Dividend mix	0.946			6.881	4.964	3.124				2				3.261		0.868	
Dividend once	0.458	-18.89	36.841	3.808	7.808	-0.244		6.256	4.244	0.218	1.91		1.487	5.327		0.568	0.438
Dividend spread high	1.308			10	1.667				6.168	0			3.667	2.37			
Emotion elicitation			105.273											12.488			
Equal endowments	0.986	25.337	46.876	9.407	3.438	23.795	0.744	9.233	5.072	0.524	2.143	0.307	2.644	4.36	0.119	0.942	1.653
Equal inflows		18.476	43.375			3.245			4.208					4.445			1.541
Experienced business	0.56			10.5	2				8	0				1.38			
Experienced non-business	0.86			8.5	3.5				4.5	0				0.8			
Extensive control questions	0.618	9.874	39.753	6.722	3.5	2.685	0.318	7.722	4.944	0.333		0.016	3.611	4.57		1.318	3.21
Fundamental value forecast		-2.411	5.541														
Fundamental value graph		-1.953	6.348														
Futures	0.92			9	5.667				10					6.85			
Gold mine framing	0.295	-0.607	5.034											2.116			
High skewness truncated	2.111	1.484	2.112	8.375	4.75			6.625	4.75	0			3.25				3.582
High skewness untruncated	1.588	-16.21	62.902	6.65	3.45			9.8	6.8	0			3.45	3.202			4.215
Increasing value	1.33	-175.3	171.696	1.278	10.861			0.861	1.139	0	5.417		0.083	5.795			0.752
Inflow 1/3	1.131		235.2			0.434								1.638			3.11

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	UnderpricedTransactions	VarianceKSWV	AmplitudeHN
Inflow 2/3	1.065		204			0.5								1.938			2.263
Informed insiders	0.402			14	0	1.61		13	13					2.175		0.57	
Interest rate 10%				15	0									5.118			
Interest rate 15%														6.832			
Interest rate 20%				15	0												
Limit price change rule	1.776					9.46		10.5	10.5					4.84		0.213	
Lottery asset				8.688	4.667								3.2	2.812			
Margin buying	1.639	50.643	72.153	9.054	3.373	10.754	0.44	8.361	6.574	1.056	0	0.315	4.574	3.864	0.032	2.391	3.893
No common knowledge	0.663	3.05	60.188	7.834	4.75	4.9	0.341	9.667	7.334	0.334		0.019	4.666	5.71		0.894	1.342
No speculation	0.628	17.172	28.654	10.029	1.904	0.379	0.289	6	2.333	0.333		0.219	2.167	0.915	0.103	2.091	7.167
Non-business	1.21			8.667	6				9	1				2.02			
Open book	0.836	9.825	61.606	7.404	4.8	5.096	0.448	8.867	7.528	1.061		0.027	4.077	5.053		1.193	3.585
Oral	0.912			8.056	4.324				7.881	1.2			4.479	1.49			
Overconfident	2.292			13.4	0.6	223.568								6.266			
Partial information	1.135			14	1			9						6.665			
Peak			83.54	8.8	2	4.658								7.8			4.372
Pre-market phase	0.31			2	9.5	1.6				0.5	3.75			2.723			
Price prediction	1.233	43.7	104.122	9.693	3.215	117.201			7.066	1.2		0.307	3.067	3.329	0.119		8.83
Profit-based compensation		12.506	43.161			2.157								3.316			1.191
Rekindle	1.142			10	1.667				4.668	0			3.667	2.095			
Reverse futures	0.331			4	4.75	0.239								0.985			
Sequential partial information	0.763							9.5						10.67			

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	UnderpricedTransactions	VarianceKSWV	AmplitudeHN
Service market				7.042	3.392							0.302		0.711	0.019		
Short selling <= 2 units	0.767					14.09		11.25	9.5					5.647		1.428	
Short selling <= 3 units		-29.7	55.933	4.5	6	10.99								13.225			1.005
Short selling <= 5 units				5.156	7.032							0.179	1.25	3.86	0.268		
Short selling <= 6 units		-43.92	69.64	5.8	7.4	24.986								20.448			1.54
Short selling <= 6 units, cash x10		513.35	527.883	11	2.5	116.445								22.86			5.73
Short selling 100% cash reserve		-56.5	72.72	2.8	10.6	20.706								21.088			1.458
Short selling 100% cash reserve, cash x10		341.55	380.533	8.5	5	117.825								34.53			5.12
Short selling 150% cash reserve		-63.3	84.8	6	9	29.965								24.75			1.29
Short selling flexible cash reserve		2.5	53.85	9	4.5	14.74								19.695			1.18
Short selling insiders	0.264					3.05		13						3.68		0.192	
Switch	0.4								4.5								
Tâtonnement	0.45			13.2	0.6	0.981								1.305			
Teams	1.012	1.132	70.234	6.166	3.666	2.776	0.669	6.666	6.416	0.334		0.015	4.25	2.222		1.62	1.495
Tournament inflows		58.656	69.464			4.917			6.416					5.436			2.489
Two asset markets	2.05	1.629	2.208	7.219	5.125			7.062	6.722	0			3.986				3.669
Underconfident	0.976			9.8	2.8	49.17								4.402			
Valley		64.104	88.789	10.584	5	6.123								8.275			6.582

Table A.4 Mean Bubble Measure Value by Treatment and Measure Type, No Multitreatment, Inexperienced Subjects

This table reports the mean measure value by treatment and measure type for only those observatiosn where the market design deviated from the baseline design by a single treatment variation only.

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	VarianceKSWV	AmplitudeHN
1/3 twice+ experienced						1.891								8.412		
2/3 twice+ experienced	0.741		146.4			0.638								3.235		1.313
2-point symmetric dividend	1.132	1.263	151.17	9.345	3.742	1.61				0.5	3.75			3.093		2.808
3-point symmetric dividend				14	1											
5-point symmetric dividend				10	3											
Announcement high, preset	0.98		58.51			4.31			5.67							
Announcement high, random	1.17		115.8			10.7			11.67							
Announcement low, preset	1.3		128.75			6.6			10.67							
Announcement low, random	1.14		112.5			9.56			11.33							
Announcement true	1.07		105.19			8.44			8.33							
Baseline	0.995	102.7	130.5	12.833	1.889	8.553		7.55	5.058	4	0		3.667	6.12	1.106	2.909
Bonus after market		8.952	28.614			1.214								3.004		0.701
Bonus after period		17.552	72.078			3.524								3.783		2.01
Brokerage fees	0.466					3.91		10	10					5.555	0.526	
Call auction	1.243	41.471	219.28	9.456	3.789	0.53		10.478	8.264	1.827			4.947	2.043		3.591
Capital gains tax	1.586			7.083	5.833	7.665								3.556		
Chat			102.31											10.241		
Comparison private 0% upward				7.2	7.2											
Comparison private 100% upward				9.8	5.2											
Comparison private 33% upward				8.5	6											
Comparison private 67% upward				7.1	6											
Comparison public downward		-3.6	72.393	7.3	4.286									9		4.4
Comparison public upward		105.1	145.53	11.4	3									9.9		6.5
Constant value		19.233	35.081	12.444	0.844	2.896			1.625					5.629		0.174

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	VarianceKSWV	AmplitudeHN
Dividend certainty	0.939	17.172	28.654	7.5	3.389	0.379	0.289	6	8.111	0.333		0.008	2.167	6.151	2.091	7.167
Dividend deferred	0.986	-25.2		8.965	2.715			13.25	9.5				4.5	1.347		4.906
Dividend mix	0.946			7.611	4.75	3.124				2				3.788	0.868	
Dividend spread high	1.308			10	1.667				6.168	0			3.667	2.37		
Emotion elicitation			107.39											13.361		
Equal endowments	1.282	26.753	49.472	9.603	3.257	28.451		10	5.833	0.5	3.75			4.609	2.22	1.898
Equal inflows		18.476	43.375			3.244			4.208					4.445		1.541
Experienced business				10.5	2											
Experienced non-business				8.5	3.5											
Extensive control questions	0.618	9.874	39.753	6.722	3.5	2.685	0.318	7.722	4.944	0.333		0.016	3.611	4.57	1.318	3.21
Fundamental value forecast		-2.411	5.541													
Fundamental value graph		-1.953	6.348													
Futures	0.92			9	5.667				10					6.85		
High skewness truncated	2.111			8.375	4.75			6.625	4.75	0			3.25			3.582
High skewness untruncated	1.655	-25.2		6.625	3.292			9.417	6.5	0			3.333	3.202		4.139
Increasing value	1.33	-175.3	171.7	1.278	10.861			0.861	1.139	0	5.417		0.083	5.607		0.752
Inflow 1/3	1.131		235.2			0.434								1.638		3.11
Inflow 2/3	1.065		204			0.5								1.938		2.263
Informed insiders	0.402			14	0	1.61		13	13					2.175	0.57	
Interest rate 10%				15	0									5.118		
Interest rate 15%														7.041		
Interest rate 20%				15	0											
Limit price change rule	1.776					9.46		10.5	10.5					4.84	0.213	
Lottery asset				8.688	4.667									2.675		
Margin buying	2.142	4.573	39	8.873	3.427	15.3		7.25	5.5	0			3	3.913	7.96	3.668
No common knowledge	0.663	3.05	60.188	7.834	4.75	4.9	0.341	9.667	7.334	0.334		0.02	4.666	5.71	0.894	1.342
No speculation	0.628	17.172	28.654	10.597	1.847	0.379	0.289	6	2.333	0.333		0.008	2.167	0.969	2.091	7.167
Non-business				8.667	6											
Open book	0.927	0.981	65.983	6.987	5	5.647	0.356	8.733	7.63	0.4		0.018	4.141	6.395	1.097	2.734

Treatment	AmplitudeK	AverageBiasHN	AverageDispersionHN	BoomDurationHN	BustDurationHN	DeviationKSWV	DispersionRatio	DurationK	DurationPS	ExtremeOverpricingAC	ExtremeUnderpricing	OverpricedTransactions	PositiveDurationACCD	TurnoverK	VarianceKSWV	AmplitudeHN
Oral				8.056	4.324				8.055				4.479			
Overconfident	2.292			13.4	0.6	223.568								6.266		
Partial information				14	1											
Pre-market phase				2	9.5	1.6				0.5	3.75			2.723		
Price prediction	1.634			9.765	3.174	136.369								4.147		
Profit-based compensation		12.506	43.161			2.157								3.316		1.191
Rekindle	1.142			10	1.667				4.668	0			3.667	2.095		
Reverse futures				4	4.75											
Service market				6.805	3.556									0.694		
Short selling <= 2 units	1.028					11.88		9.5	9.5					6.67	2.2	
Short selling <= 3 units		-29.7	55.933	4.5	6	10.99								13.225		1.005
Short selling <= 5 units				5.156	7.031									3.99		
Short selling <= 6 units		-43.92	69.64	5.8	7.4	24.986								20.448		1.54
Short selling <= 6 units, cash x10		513.35	527.88	11	2.5	116.445								22.86		5.73
Short selling 100% cash reserve		-56.5	72.72	2.8	10.6	20.706								21.088		1.458
Short selling 100% cash reserve, cash x10		341.55	380.53	8.5	5	117.825								34.53		5.12
Short selling 150% cash reserve		-63.3	84.8	6	9	29.965								24.75		1.29
Short selling flexible cash reserve		2.5	53.85	9	4.5	14.74								19.695		1.18
Short selling insiders	0.264					3.05		13						3.68	0.192	
Switch	0.4								4.5							
Tâtonnement	0.45			13.2	0.6	0.981								1.305		
Tournament inflows		58.656	69.464			4.917			6.416					5.436		2.489
Two asset markets	2.05			7.192	5.146			7.062	6.722	0			3.986			3.668
Underconfident	0.976			9.8	2.8	49.17								4.402		

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