# ФИНАНСЫ, КРЕДИТ, СТРАХОВАНИЕ

УДК 336.6

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## ARE ASSET MARKETS EFFICIENT? EVIDENCE FROM ECONOMIC EXPERIMENTS

The assumed superiority of market economy compared with central planning is based on the belief that markets are able to aggregate disperse information about production costs and demand of goods in the form of efficient market prices. Asset markets and futures markets for commodities and assets are believed to evaluate expected future developments — as far as this is possible in the face of fundamental uncertainties. Market failure exists (e.g. because of market power or externalities) and has to be counteracted by state intervention (e.g. cartel authorities or Pigou taxes), but, in principle, free markets are assumed to be the optimal institution. Is this always true, in particular also for asset markets which seem to have a tendency to inflate "bubbles" for which there are many large scale examples? Experimental investigations of asset markets show that, in most cases, market prices "ultimately" converge to optimal Rational Expectation prices. Markets are able to aggregate disperse information, but this process needs time and also the systematic occurrence of biases, in particular bubbles, is reported. The most important determinant for the prevention of bubbles is personal experience. Refs 48. Figs 5.

*Keywords:* Asset markets, efficiency, Rational Expectations, experimental research.

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**ЭФФЕКТИВНЫ ЛИ РЫНКИ АКТИВОВ? ДАННЫЕ ЭКОНОМИЧЕСКИХ ЭКСПЕРИМЕНТОВ**

Предполагаемое превосходство рыночной экономики по сравнению с централизованным планированием основано на убеждении, что рынки способны агрегировать распределенную информацию об издержках производства и спросе на товары в форме эффективных рыночных цен. Предполагается, что рынки активов и рынки фьючерсов на товары и активы способны оценивать ожидаемые будущие изменения — насколько это возможно в условиях принципиальной неопределенности. «Провалы рынка» существуют (например, обусловленные рыночным господством или экстерналиями) и должны компенсироваться вмешательством государства (антимонопольные меры или налоги Пигу), но в принципе считается, что свободный рынок является оптимальным институтом. Всегда ли это верно, в особенности для рынков активов, которые имеют тенденцию к раздуванию «пузырей», впечатляющие примеры которых мы наблюдаем? Экспериментальные исследования рынков активов показывают, что в большинстве случаев рыночные цены в итоге приближаются к оптимальным ценам (согласно теории Рациональных ожиданий). Рынки в состоянии агрегировать распределенную информацию, но для этого процесса требуется время, а также встречается систематическое появление отклонений. Наиболее важным фактором предотвращения «пузырей» выступает личный опыт. Библиогр. 48 назв. Ил. 5.

*Ключевые слова*: рынки активов, эффективность, теория рациональных ожиданий, экспериментальные исследования.

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## 1. Incompatible theories regarding expectation formation?

The Nobel Prize 2013 in Economics has been awarded to Eugene F. Fama, Lars Peter Hansen and Robert J. Shiller "for their empirical analysis of asset prices" (http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/). This may remind us of an old joke, namely that "Economics is the only field in which two people can share a Nobel Prize for saying opposing things" (http://netec.mcc.ac.uk/JokEc.html). Fama and Shiller really seem to have completely opposite opinions about the efficiency of markets. While Fama believes that markets are able to aggregate disperse information efficiently which ultimately results in Rational Expectations and Efficient Markets, Shiller is famous for successfully forecasting the bursting of the last two big bubbles (the dotcom and the housing bubble, see [Shiller, 2005]). He believes that actors in the markets are only bounded rational or even irrational and that they underlie a lot of well-known biases (e.g. herding, loss aversion, and overconfidence, see [Akerlof, Shiller, 2009]). While Shiller does not believe in the efficiency of markets, Fama does not accept the existence of bubbles — which is, of course, also a question of definition. Fama's central argument is that you cannot beat the market [Fama, 1970; 1998], while Shiller points out that there are significant deviations from Rational Expectation prices, e. g. the variance of stock prices is far larger than the variance of Fundamental Values [Shiller, 1981].

This controversy is a central topic for economics and society. The assumed superiority of market economies compared with central planning is based on the belief that markets are able to aggregate information about production costs and demand of goods in the form of efficient market prices. Asset markets and futures markets for commodities and assets are believed to evaluate expected future developments — as far as this is possible in the face of fundamental uncertainties. Market failure exists (e. g. because of market power or externalities) and has to be counteracted by state intervention (e. g. cartel authorities or Pigou taxes) but, in principle, free markets are assumed to be the optimal institutions. Is this always true, in particular also for asset markets? The empirical evidence from *field data* seems to allow contradicting answers.

Is Economics really the only field with completely contrarian opinions of its scholars? Certainly not! Even the most admired of our sciences, physics, has to cope with the contradictions of its two fundamental theories, Quantum and Relativity Theory. Both are nonetheless extraordinarily successful because there are hardly any intersections of their fields of application. (Black holes and the Big Bang are such exceptions.) We may learn two things from this comparison. First, perhaps we should not ask whether Fama or Shiller are right but under which circumstances one or the other is right. The existence of bubbles and their forecasted bursting seems to prove Shiller's point of view, and there are economists who doubt that Fama has earned the Nobel prize under these circumstances, but we should keep in mind that these extreme events are rare and that a theory also has to explain the "quiet" working of many markets over many years. Second, Physics has gained such a deep understanding of nature through its use of experiments. Only in the *laboratory* is it possible to create controlled environments with one factor variations which are ideal for the qualitative and quantitative testing of theories.

The discipline of *Experimental Economics* has developed from very humble beginnings in the 1950s and 60s into a toolbox which is now used or at least accepted by most contemporary economists and which ideally supplements the investigation of field data.

Only in the laboratory do we have (some) control over the environment, information, and incentives of the actors. Experiments with people, however, can never have the precision of physical experiments with dead matter. Every subject is unique, giving him information does not guarantee its reception and use, and incentives can be influenced but never completely determined. Nonetheless we have gained a lot of knowledge about situations where economic standard theory works at a satisfactory level and situations where it needs to be revised.

Three economists have won the Nobel prize partly or wholly because of their experimental work: (Alvin E. Roth, 2012, together with the theorist Lloyd S. Shapley) "for the theory of stable allocations and the practice of market design"; Elinor Ostrom (2009) "for her analysis of economic governance, especially the commons" and Vernon L. Smith (2002, together with the psychologist Daniel Kahneman) "for having established laboratory experiments as a tool in empirical economic analysis, especially in the study of alternative market mechanisms" (http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/). All three were concerned with special markets (Smith also with asset markets), with questions of efficiency and efficiency enhancing institutions.

In the following we will present and discuss asset market experiments and related experimental results. Note that this will not be an exhaustive report but a selected survey. We will not find a clear case for Fama or Shiller but we will see that Experimental Economics describes the coexistence of efficient markets with successful aggregation of information and the inflating and bursting of bubbles.

## 2. Typical asset market experiments and associated hypotheses

Mostly, such an experimental market consists of six, nine or twelve investors/traders who are endowed by the experimenter, symmetrically or asymmetrically, with a number of assets and an amount of money. In most experiments, there is only one asset in the market but there are also experiments with a larger number of assets. The markets are partitioned in one, two, ten, fifteen or even more market periods. The number of periods can also be endogenous, namely by introducing a probability with which, before a new period begins, all assets lose their value and the market shuts. At the end of every period an asset earns an independently distributed stochastic dividend. Anticipation of all future dividends determines the fundamental value of the asset. In markets with an exogenously determined number of periods, it is a linearly decreasing function of the period number. In many one-period experiments, some of the traders are informed in advance about the dividend. The market institution is sometimes established as a double auction but mostly as a continuous auction with an open order book. All traders can buy and sell under the restriction of their endowments with assets and cash. In some experiments, however, also short selling is possible. At least after each period the traders are provided with information about (average) transaction prices.

Experiments are conducted in the classroom, in the laboratory where every trader subject decides via his own PC, or in the Internet. In every case the experimenter tries (mostly successfully) to create situations with anonymous decisions. With some exceptions, the trader subjects are paid according to their final wealth. (Note that, after the last dividend payment, assets have no value at all.)

The theoretical benchmark price for a market without insider information and with risk neutral traders is the sum of expected dividends over the remaining periods. If there are insiders in a one-period market who know the dividend in advance, it is expected that their knowledge is spread (in a continuous auction) via their bidding behavior and "ultimately" makes the market price equal to the dividend.

Under the assumption of general risk aversion prices may be a little lower. We also have to take into account that, with every period, a trader's ratio of capital to asset value changes. Dividend payments increase his monetary wealth and, in asset markets with a finite number of periods, the fundamental value of his assets decreases. In addition, the riskiness of the assets increases when dividends are aggregated over a smaller number of periods. The former influence should increase the demand for assets; the latter should decrease it (under general risk aversion). Therefore prices may be expected to increase or decrease a bit, but general risk aversion would always pose a limit, namely the risk neutral fundamental values.

## 3. Early experiments: Support of a realistic version of the Efficient Market Hypothesis

Let us briefly mention that asset market experiments were preceded (e.g. [Chamberlain, 1948; Smith, 1962]) and accompanied by *goods market experiments* whose decisive difference is the existence of producers with given costs and consumers with given (monetary) utilities so that buyers and sellers were predetermined. Usually convergence to competitive prices was observed where the velocity of convergence somewhat depends on experimental details and market institutions. In particular posted prices instead of double auctions may decrease the adjustment speed [Plott, 1986] or even allow prices to remain above competitive levels [Davis, Holt, 1996].

Fundamentally different are experiments where seller subjects were provided with real items (apples, pencils, chocolate bars, or mugs) instead of an abstract cost function for the production of goods. If these potential sellers are asked to indicate their willingness to accept (= minimum price they require) and potential buyers who had not received an object are asked to reveal their willingness to pay then the double auction defined by these bids shows a surprising asymmetry. If the intrinsic value of the object had the same distribution among sellers and buyers (and if both sides did not believe that one of them had market power) then half of the items should have been exchanged. Contrary to this prediction, in a large number of experiments sellers turned out to pose significantly larger bids than buyers and significantly less than half of the items was traded. For an overview about such experiments and the general confirmation of this "endowment effect" see [Kahnemann et al.,1990; List, 2003], however, shows that professional traders (of game cards) do not underlie this bias. An important difference seems to exist between people taking possession of an object and trading goods to which they have only an abstract relation. For a broader discussion of the endowment effect under the aspect of cultural influences see Apicella (forthcoming).

Altogether, goods markets converge to efficient prices although somewhat depending on market institutions and not without biases when evaluating personally owned objects. Let us now turn to our main topic, experimental asset markets.

Early experiments with *asset markets* usually had one (or at most two) periods but continuous auctions with many transaction prices. Often part of the traders was informed about the fundamental value while the others knew only their distribution. [Forsythe et al., 1982] with two-period markets and deterministic dividends and [Plott, Sunder, 1982] with one-period markets and stochastic dividends for different types of traders support Fama's Efficient Market hypothesis. They find prices converging to Fundamental Values, although not at once but in the course of several repeated markets. The less informed traders there are [von Borries, Friedman, 1989; Sunder, 1992] and the larger the number of states of the world [Plott, Sunder, 1982] the slower the convergence is. These results are exactly as we expect them to be if we take into account that information cannot be processed without time and costs, i. e. if we substitute the fictitious economic (super)man with the bounded rational homo sapiens who is still expected, however, to aggregate dispersed information successfully.

An experiment which is particularly supporting this view is described in Sunder (1992). In ten successive one-period markets two states of the world with different fundamental values were selected randomly. The three trader types had different values for the asset depending on the state of the world. In an efficient market, the traders of the type with the maximal value should ultimately buy all assets. Under the assumption of strong competition between the four traders of the highest value type, prices should be equal to fundamental values. The special feature of this experiment was that the 12 traders submitted bids for the ex ante information about the state of the world. The traders with the highest four bids got the information and had to pay the fifth highest bid. The result of this experiment is shown in Figure 1. In the lower part of Figure 1 we see the fundamental value as a constant line whose two possible values are randomly determined from period to period. In addition there is the curve which connects all transaction prices in the continuous auction. We see that, in the first four markets, the convergence of prices to fundamental values is not impressive, but from the fifth market on, prices quickly and closely resemble Rational Expectations/ Fundamental Values. The uninformed traders seem to have learned to interpret the price bids in the market. At the same time, the bids for information decrease

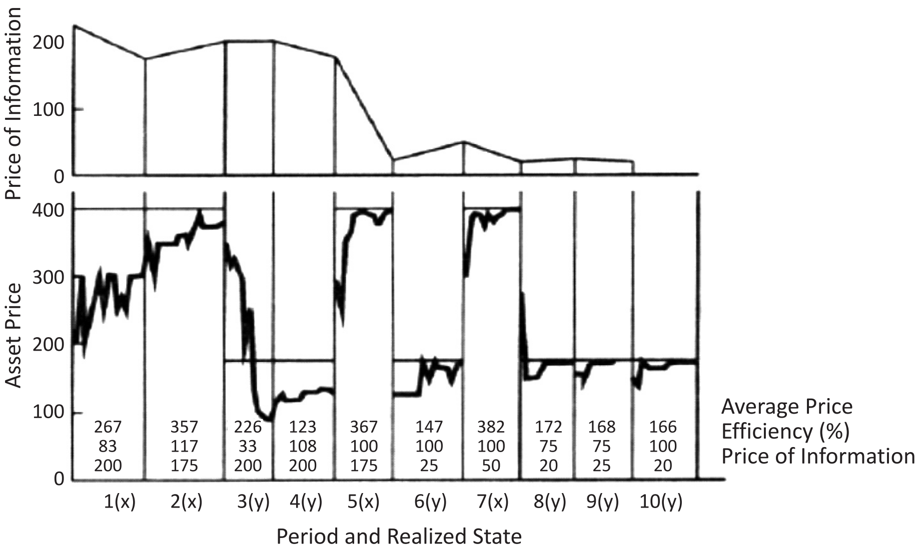


*Figure 1.* Lower part: Fundamental values and transaction prices in ten successive experimental asset markets. Upper part: Auction prices for the ex ante information about the state of the world (x or y).

Source: [Sunder, 1995].

drastically (upper part of Figure 1). It is still the case that informed bidders earn a bit more than uninformed bidders — but their advantage is not greater than the price they have to pay for the information. So this is, after a necessary process of learning, a double confirmation of the Efficient Market Hypothesis: Prices of assets, as well as prices for information, take values which allow the efficient allocation of the assets without earning extra rents from better information.

Forsythe et al. [1984], Friedman et al. [1984], and Kluger and Wyatt [1995] show that, as to be expected, the aggregation of information can be significantly supported by the introduction of Futures or Option markets.

So far Fama's belief in Efficient Markets and Rational Expectations (RE) seems to be strongly supported. The fact that some learning is necessary to approach RE is not really restricting but more trust enhancing because the instantaneous aggregation of information would have been a difficult to explain miracle. But can we always expect such a convergence to RE, or are there principle reasons why this sometimes might not happen?

## 4. Are there free-floating expectations? Evidence from Beauty Contest Experiments

Keynes [1936] in "The General Theory of Employment, Interest and Money" asks which girl to choose if one had to predict the result of a beauty contest. A naïve (level 0) predictor would choose the girl who is, in his eyes, the prettiest one. A less naïve (level 1) predictor would expect others to follow their own tastes while he would try to guess which girl might be the prettiest in the eyes of the others. But why not expect the others to try to guess their fellow predictors' tastes and try to estimate (level 2) the result of the level 1 estimation? We can climb up this ladder of more and more sophisticated guesses step by step. Under such reasoning, our behavior is completely determined by our expectations about the behavior of our co-players. After substituting the "prettiest girl" with the "asset with the highest price increase" we may suppose that also the market price of assets is solely determined by "free floating" expectations.

In Game Theory the concept of the Nash Equilibrium usually restricts the system of expectations (beliefs) the players can hold by requiring expected behavior of every player to be a best reply to the expected behavior of other players. In many cases, only one or a small number of belief systems survive this consistency requirement. On the other hand, it is sufficient to doubt the rationality of a few co-players in order to establish again a large variety of possible beliefs about all players' actions.

Nagel [1995] implemented the Beauty Contest game in the following way. Each of a large number of players chooses a number between 0 and 100. That player who chooses $p^*$(average of all numbers) wins a prize. This game has often been replicated, in the classroom, in the laboratory, in the Internet, and also with the readers of some newspapers or journals. In most of these experiments p was 2/3. Applying the logic of iterated beliefs as explained above, level 0 is defined as the random choice of a number between 0 and 100. Under the assumption that the average of these random numbers is 50, level 1 players should choose $2/3*50 = 33.3$. If I expect all players to choose 33.3, I will win with every number between (about) 11.1 and 33.3, the most plausible choice being 22.2. Accordingly, we can proceed to higher levels. The unique Nash equilibrium coincides with level $\infty$ reasoning, where all players choose 0.

A large data set of results of Beauty Contest experiments is provided by Bosch-Domenech et al. [2002]. In Figure 2 we see the frequency distribution which resulted from the guesses of readers of the Financial Times and Spektrum der Wissenschaft. The use of iterated beliefs is suggestive when we see the spikes at 33 and 22 and also the large spikes at and just above 0. A reliable interpretation of such data needs, however, a careful formulation of hypotheses and sophisticated methods of econometrics [Breitmoser, 2012]. The fact that the majority of players do not play Nash equilibrium is completely clear. Thus behavior is based on free-floating (and inconsistent) expectations. The same type of behavior (though with smaller numbers) is even found when the subjects are game theorists and when this is common knowledge. So, it is not sufficient to be an expert. On the other hand, repetitions of the game with the same subjects lead to fast decreasing guesses, i. e. personal experience increases the rationality of expectations.

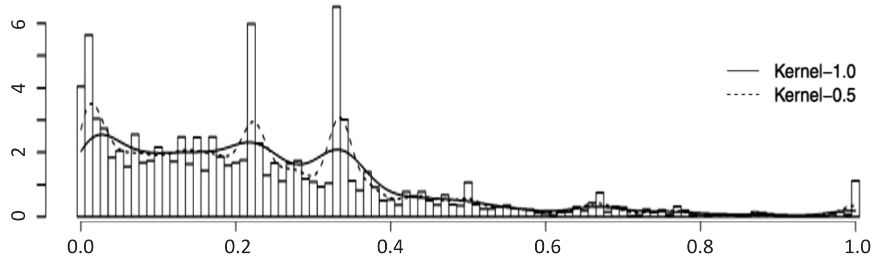


*Figure 2.* Choices by the readers of Financial Times ($n$ = 1476) and Spektrum der Wissenschaft ($n$ = 2728) of numbers in a p-beauty contest game with $p = 2/3$.
Source: [Breitmoser, 2012].

Keynes' original Beauty Contest can best be identified with $p = 1$ (and the consequence of infinitely many equilibria). Karmann and Lehmann-Waffenschmidt [2001] have pointed out that there are games similar to Beauty Contests with $p > 1$. If firms go public then they often do this with a fixed price auction for their shares. Often the result is an over-subscription and a subsequent proportional rationing of the demand of all bidders. If bidders expect oversubscription by the factor p then they will demand p times their true demand. If they expect all others to oversubscribe by the factor p they should bid for $p^2$ times their true demand, etc. In reality, many hotels and airlines mildly overbook their capacity. The author's home university accepts five times and more applications from business students than its capacity seems to allow; but it is well-known that more than 80% of the applicants will ultimately study elsewhere. Also experiments [Karmann and Lehmann-Waffenschmidt, 2001; Grimm et al., 2006] show that over-subscription is frequent and increases from round to round when played by the same subjects. Note, however, that approaching an equilibrium gradually is impossible because, for $p > 1$, an equilibrium does not exist or is instable[1].

[1] In over-subscription games equilibria with mixed strategies might exist. In a real beauty contest game with $p \leq N/2$, $N$ = number of players, all guessing 0 is still an (instable) equilibrium. For $p > N/2$, there is no equilibrium (neither in pure nor in mixed strategies). Ephraim Kishon describes this game in his short story "Jewish Poker". The rules of this two-person game are: "*You think of a number, I also think of a number… Whoever thinks of a higher number wins*" (http://www.ephraimkishon.de/en/my_favorite_stories.htm).

## 5. Bubbles in Asset Market Experiments

Free-floating expectations may result in *false equilibria* (prices permanently and constantly away from fundamental values) and *bubbles* which inflate (prices increase significantly above fundamental values) and burst (prices crash down to fundamental values or even below). Such a definition of a bubble is easy to check in an experiment where the fundamental values are known while it is always difficult in real asset markets to estimate the path of fundamental values. Bubbles are a dynamic phenomenon and therefore are less likely to be observed in markets with one or two periods although, in principle, this is possible with continuous trade over long enough periods. It is easier, however, to observe and perhaps extrapolate price developments if statistics of average prices or all transaction prices are presented over a number of periods. We will see that bubbles are observed regularly in asset markets with 10 or 15 periods (Figure 3).

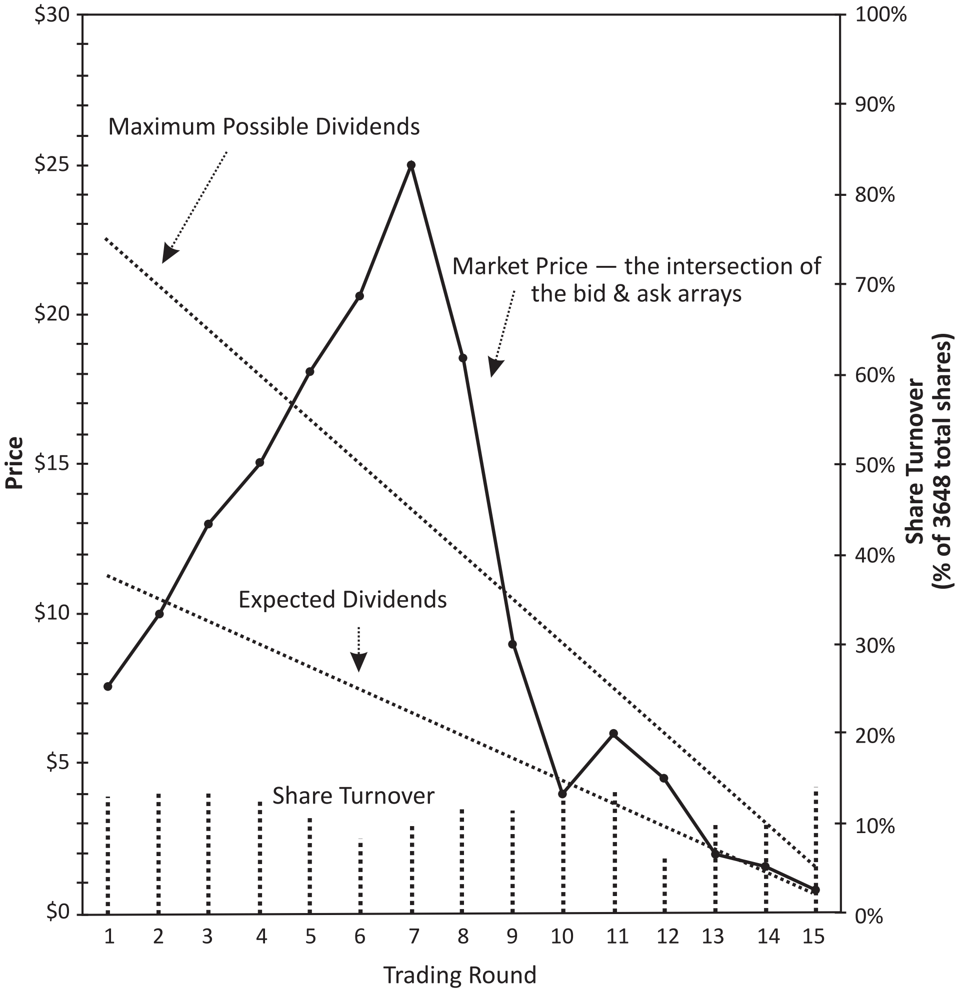


*Figure 3.* A bubble in a classroom experiment. $N = 304$.

Source: [Williams, 2008].

In Figure 3, a typical bubble is described. The dotted lines show the fundamental values (under risk neutrality) and the maximal possible sum of dividends over the remaining periods (rounds). Prices rise to a peak in round 7 and then crash to the fundamental value in round 10 where it more or less remains until the final round 15. The interesting feature[2] of this internet based experiment with students of an Economics course is its large number of players (304) and the fact that, with two periods of continuous trading per week, the developing bubble was presented to all participants in a twice per week updated curve and was openly discussed by them. It was clear for everybody that prices were above their fundamental value. At least in this experiment, the bubble was not caused by "confusion" about fundamental values.

Williams is one of the authors of the "classical" series of asset experiments [Smith et al., 1988] where bubbles were regularly found. The experiments were organized as described in the section on typical asset market experiments. The only condition under which reliably no bubbles developed was the second repetition of the same market with the same participants. Learning to avoid a bubble is possible but takes time.

Two other important messages of Smith et al. [1988] were that, first, real people do not solve problems like decision theorists, namely by ex ante reasoning and backward induction. They look backward, have adaptive expectations (which ultimately converge to RE) and learn from their mistakes and successes instead of looking forward and deriving their expectations by reasoning. Second, the frequent observation of bubbles does not contradict Fama's Efficient Market Hypothesis because there is no possibility of arbitrage profits in their markets. Ex post, a bubble looks as if it could easily be exploited but, ex ante, it is difficult to determine when to buy and when to sell.

In the following, a large number of experiments was conducted in order to identify the conditions under which bubbles grow and burst [King et al., 1992; Smith et al., 1993; Smith et al., 2000; Caginalp et al., 2000; Noussair, Tucker, 2006; Haruvy, Noussair, 2006]. They do not find bubbles less frequently after the introduction of short selling or brokerage fees. Substituting student subjects with small business people, mid-level corporate executives, or over-the-counter market dealers did not make a difference either (see Figure 4). The introduction of futures markets has some effect, namely by reducing the amplitude of bubbles, possibly even so much that no significant difference to fundamental values remains.

The most reliable prevention of bubbles, however, was a confirmation of Smith et al. [1988]. Traders who have experienced a bubble already twice will not cause a new bubble! As Hussam et al. [2008] show, however, these experiences may not help if the environment changes. Then the same players may inflate a bubble again. Dufwenberg et al. [2005] found that, after the experience of two bubbles, it was possible to substitute up to 2/3 of the experienced traders with novices without causing a new bubble. In Figure 5 we see, how bubbles (or false equilibria) develop in the first two market rounds. In the third round there is no significant difference between prices and fundamental values and neither are there significant differences in the fourth round where 2 or 4 of the six experienced traders were substituted with inexperienced ones.

[2] A not so nice feature is that subjects are not paid in cash as in other experiments but in credits for their course according to their final profits.

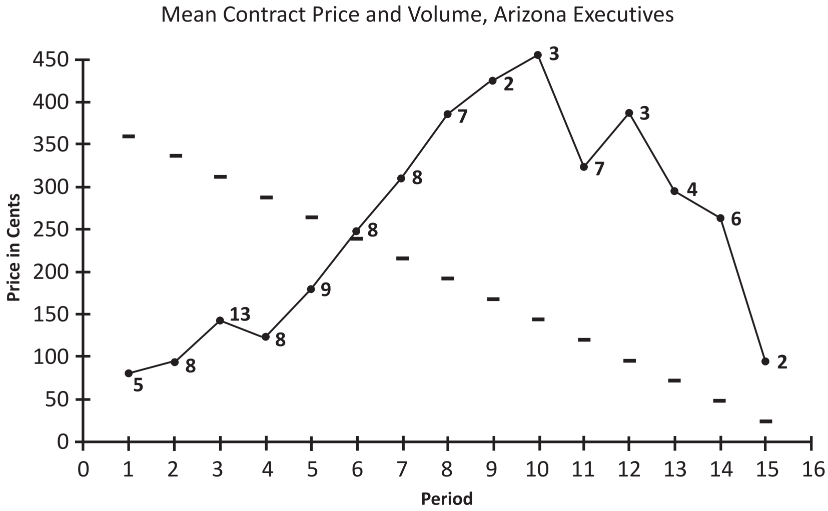


*Figure* 4. A bubble produced by mid-level corporate executives.
Source: [Caginalp et al., 2000].

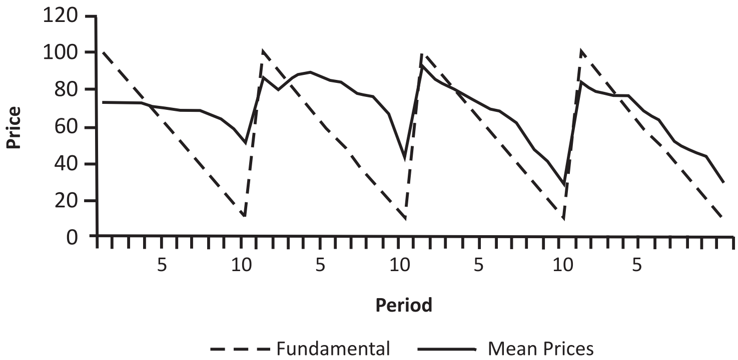


*Figure 5.* Observed Prices and Fundamental Values in four market rounds.
Source: [Dufwenberg et al., 2005].

One of the possible reasons for the development of bubbles in experimental markets has been assumed to be confusion about the decreasing fundamental values in most bubble experiments. Alternatives to the payment of dividends in each of a finite number of periods are (i) the payment of the sum of dividends only at the end of the last period, (ii) a "dividend" with an expectation value of 0, or (iii) a constant survival probability of the asset. Camerer and Weigelt [1990], Smith et al. [2000], Oechssler et al. [2011], and Kirchler et al. [2012] find bubbles less often under these circumstances. But a constant fundamental value is no guarantee of the avoidance of bubbles. Oechssler et al. [2011] find that the positive probability that a small number of insiders exists is sufficient to make bubbles as frequent as in the literature with decreasing fundamental values.

As discussed in the first section, Shiller assumes that bubbles are created because of systematic biases of market participants. Some of these biases may be "rational" because of distorted incentives; others are genuine deviations from rational behavior. The former are due to the fact that today only a minority of investors make trading decisions themselves. Instead, professional traders act as agents for the investors. If the traders are paid only according to their profits (perhaps even more than proportionally) and do not participate in the losses they cause, then the rational reply to such incentives should be an overly strong preference for risk. Holmen et al. [2013] find exactly this effect in the laboratory.

Do professional traders underlie similar biases as ordinary people? We have already learned above that they also produce bubbles in the laboratory. Locke and Mann [2005] find that they show loss aversion and Haigh and List (2005) confirm this result ("losses loom larger than gains") with traders of the Chicago Board of Trade (2005). It is astonishing that Alevy, Haigh and List [2007] contradict this observation, seemingly with same subject pool. According to their new findings, traders process information more efficiently than student subjects and show no loss aversion. Glaser et al. [2005] find that "the masters of the universe", as financial traders are sometimes called because of their assumed hybris, show really even more overconfidence than students. Cipriani und Guarino [2009] do not find herding among traders but the contrary, namely speculation against the market where they should not and too little following the market where they should. Note that such evaluations are far easier in experiments where we (and the subjects ought to) know the optimal course of behavior.

## 6. Conclusion

Experiments with asset markets have identified many factors influencing the ability of markets to process information and find efficient prices. There are even more details to take into account than included in this short survey. So far, no "behavioral asset market theory" is available. A two-factor model of Smith et al. [2000] does not describe their experimental results convincingly.

The main results of this survey on experimental asset markets are:

(i) Ultimately, experimental markets approach RE prices. The coordination of trades and (if information is distributed among the players) the aggregation of knowledge need time. In the beginning, prices may show stochastic deviations from RE or even systematic biases.

(ii) Futures and options markets speed up the convergence of spot market prices to RE prices and reduce the magnitude or even prevent systematic biases.

(iii) In asset markets with many (10 or more) periods bubbles are regularly observed.

(iv) Having experienced bubbles twice (by a sufficient number of market participants, in a similar environment) seems to be the only guarantee for the elimination of bubbles. General expertise with markets, the existence of futures markets, and assets with constant values *sometimes* prevent bubbles to blow up.

(v) Professional traders are not immune to biases like overconfidence and loss aversion. Asymmetric incentives (higher participation in profits than in losses) increase risk taking behavior of trader agents.

The bursting of the American housing bubble in 2007 sent shock waves through the world financial system. Banks in almost all countries suffered heavy losses and often had to be rescued by their national governments. The banking crisis was accompanied by a worldwide recession which caused countries to stimulate growth through considerable deficit spending. For many countries these deficits added to already existing high debt levels and deteriorated their credit ratings. The following debt crisis in the Euro area and beyond may have been inevitable anyway but it was certainly accelerated and worsened by this course of events.

So it is only natural to ask how to prevent the next big bubble. The discussion focuses on institutional changes with more regulation, e.g. increased reserve requirements, and changes of incentives, e.g. bonuses based on long-term instead of short-term profits. Perhaps these measures should be supplemented with requirements on the experience of traders before they are allowed to speculate with billions of dollars. The normal trader is relatively young, also because "many traders retire after 10 or 20 years of service" [Fabre, 2007]. In the face of the considerable internal and external losses which inexperienced traders can cause, they might be required to undergo an extended training on and off-the-job, perhaps comparable with the training of medical specialists. In Germany, these doctors have to serve five years in a specialist department of a hospital before they are allowed to treat patients in their own practice or under their own responsibility in a hospital. It is well known that, in this and in other professions, human capital is accumulated mainly through experience!

In an interview in the Wall Street Journal, as early as 1987, Vernon Smith said "People panic, … these bubbles and crashes would be a lot less likely if the same traders were in the market all the time." But, he notes, "novices are always entering the market" [http://online.wsj.com/news/articles/SB122360084765021629]. 26 years later we have experienced a lot of successive small and large bubbles in real as well in experimental markets, but at least from the viewpoint of experimental research Vernon Smith's conjecture need not be revised.

**References**

*Akerlof G. A., Shiller R. J.* Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism. Princeton University Press, 2009.

*Alevy J. A., Haigh M. S., List J. A.* Information Cascades: Evidence from a Field Experiment with Financial Market Professionals // Journal of Finance. 2007. Vol. 62(1). P. 151–180.

*Borries A. von, Friedman D.* Monopolist Insiders in a Computerized Asset Market: A Note on some Experimental Results // Working Paper. Santa Cruz: University of California, 1989.

*Bosch-Domenech A., Montalvo J., Nagel R., Satorra A.* One, two, (three), infinity, …: Newspaper and Lab Beauty Contest Experiments // American Economic Review, 2002. Vol. 92(5). P. 1687–1701.

*Breitmoser Y.* Strategic Reasoning in p-beauty Contests. Games and Economic Behavior, Elsevier, 2012. Vol. 75(2). P. 555–569.

*Caginalp G., Porter D., Smith V. L.* Overreactions, Momentum, and Price Bubbles in Laboratory and Field Asset Markets // The Journal of Psychology and Finacial Markets. 2000. Vol. 1. P. 24–48.

*Camerer C., Weigelt K.* Information Mirages in Experimental Asset Markets // Journal of Business. 1990. N 64. P. 463–493.

*Chamberlin E. H.* An Experimental Imperfect Market // The Journal of Political Economy. 1948. Vol. 56 (2). P. 95–108.

*Cipriani M., Guarino A.* Herd Behavior in Financial Markets: An Experiment with Financial Market Professionals // Journal of the European Economic Association. 2009. Vol. 7, Is. 1. P. 206–233.

*Davis D. D., Holt C. A.* Markets with Posted Prices: Recent Results from the Laboratory // Investigationes Economicas, 1996. Vol. 20(3). P. 291–320.

*Dufwenberg M., Tobias Lindqvist, Evan Moore.* Bubbles and Experience: An Experiment // American Economic Review. 2005. Vol. 95(5). P. 1731–1737.

*Fabre J.* (2007). The trader's job. URL: http://www.fimarkets.com/pagesen/trader-job.php.

*Fama E.* Efficient Capital Markets. A Review of Theory and Empirical Work // The Journal of Finance. 1970. Vol. 25(2). P. 383–417.

*Fama E.* Market Efficiency, Long-term Returns and Behavioral Finance // Journal of Financial Economics. 1998. Vol. 49. P. 283–306.

*Forsythe R., Palfrey T. R., Plott C. R.* Futures Markets and Informational Efficiency: A Laboratory Examination // The Journal of Finance. 1984. Vol. 39 (4). P. 955–981.

*Forsythe R., Palfrey T. R., Plot C. R.* Asset Valuation in an Experimental Market // Econometrica. 1982. P. 537–567.

*Friedman D., Harrison G., Salmon J.* The Informational Efficiency of Experimental Asset Markets // Journal of Political Economy, 1984. Vol. 92. P. 349–408.

*Glaser M., Langer T., Weber M.* Overconfidence of Professionals and Laymen: Individual Differences Within and Between Tasks? Unpublished manuscript. 2005.

*Grimm V., Kovarik J., Ponti G.* Fixed Price plus Rationing: An Experiment // Experimental Economics. 2006. Vol. 1(4). P. 402–422.

*Haigh M. S., List J. A.* Do Traders Exhibit Myopic Loss Aversion? An Experimental Analysis // Journal of Finance. 2005. Vol. 60(1). P. 524–534.

*Haruvy E., Noussair C. N.* The Effect of Short Selling on Bubbles and Crashes in Experimental Spot Assset Markets // Journal of Finance, 2006. Vol. 61. P. 1119–1157.

*Holmen M., Kirchler M., Kleinlercher D.* Do Option-like Incentives Drive Bubbles? Evidence from Experimental Asset Markets. Unpublished manuscript. 2013.

*Hussam R. N., Porter D., Smith V. L.* Thar she Blows: Can Bubbles be Rekindled with Experienced Subjects? // American Economic Review. 2008. Vol. 98(3). P. 924–937.

*Kahnemann D., Knetsch J. L., Thaler R. H.* Experimental Tests of the Endowment Effect and the Coase Theorem // The Journal of Political Economy. 1990. Vol. 98(6). P. 1325–1348.

*Karmann A., Lehmann-Waffenschmidt M.* High Order Strategic Thinking. The Subscriber's Dilemma in an Experimental Stock Issuing and the Keynesian Beauty Contest // Advances in Behavioral Economics. Essays in Honor of Horst Todt / eds F. Bolle, M. Carlberg. New York; Heidelberg, 2001. P. 191–207.

*Keynes J. M.* The General Theory of Employment, Interest and Money. Macmillan Cambridge University Press, 1936.

*King R. R., Smith V. L., Williams A. W., Boening M. van.* The Robustness of Bubbles and Crashes in Experimental Stock Markets // Nonlinear Dynamics and Evolutionary Economics / eds Prigone, Day, Chen. Oxford University Press, 1992.

*Kirchler M., Huber J., Stoeckl T.* Thar she Bursts: Reducing Confusion Reduces Bubbles // American Economic Review. 2012. Vol. 102(2).

*Kluger B. D., Wyatt S. B.* Options and Efficiency // Review of Quantitative and Finance Accounting. 1995. N 5. P. 179–201.

*List J. R.* Does Market Experience Eliminate Market Anomalies? // Quarterly Journal of Economics. 2003. Vol. 118. P. 41–71.

*Locke P. R., Mann S.* Professional Trader Discipline and Trade Disposition // Journal of Financial Economics. 2005. Vol. 76(2). P. 401–444.

*Nagel R.* Unraveling in Guessing Games: An Experimental Study // American Economic Review. 1995. Vol. 85 (5). P. 1313–1326.

*Noussair C. N., Tucker S.* Futures Markets and Bubble Formation in Experimental Asset Markets // Pacific Economic Review, 2006. Vol. 11. P. 167–184.

*Oechssler J., Schmidt C., Schnedler W.* On the Ingredients for Bubble Formation: Informed Traders and Communication // Journal of Economic Dynamics and Control. 2011. Vol. 35(11). P. 1831–1851.

*Plott C. R.* The Posted Offer Trading Institution // Science. 1986. N 232. P. 732–738.

*Plott C. R., Sunder S.* Rational Expectations and the Aggregation of Diverse Information in Laboratory Security Markets // Econometrica. 1988. P. 1085–1118.

*Plott C., Sunder S.* Efficiency of Experimental Security Markets with Insider Information: An Application of Rational-Expectations Models // Journal of Political Economy. 1982. Vol. 90. P. 663–698.

*Plott C. R.* Markets as Information Gathering Tools // Southern Economic Journal. 2000. Vol. 67(1). P. 1–15.

*Shiller R. J.* Irrational Exuberance: 2 ed. (1 ed. — 2000). Princeton University Press, 2005.

*Shiller R. J.* Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends? // American Economic Review. 1981. Vol. 71. P. 421–436.

*Smith V. L.* An Experimental Study of Competitive Market Behavior // Journal of Political Economy. 1962. Vol. 70(2). P. 111–137.

*Smith V. L., Suchanek G. L., Williams A.* Bubbles, Crashes, and Endogenous Expectations in Experimental Spot Asset Markets // Econometrica. 1988. Vol. 56. P. 1119–1151.

*Smith V. L., Caginalp G., Porter D.* Overreaction, Momentum, Liquidity and Price Bubbles in Laboratory and Field Asset Markets // The Journal of Psychology & Financial Markets . 2000. Vol. 1. P. 24–48.
*Smith V. L., van Boening M., Wellford C. P.* Dividend timing and behavior in laboratory asset markets // Economic Theory. 2000. Vol. 16(3). P. 567–583.
*Smith V. L., King R. R., Williams A. W., Boening M. van.* The Robustness of Bubbles and Crashes in Experimental Stock Markets. Non Linear Dynamics and Evolutionary Economics / eds R. Day, P. Chen. Oxford: Oxford Press, 1993.
*Sunder S.* Market for Information: Experimental Evidence // Econometrica. 1992. Vol. 60(3). P. 667–695.
*Sunder S.* Experimental Asset Markets: A Survey // Handbook of Experimental Economics / eds Kagel, Ross. Princeton University Press, 1995. P. 445–500.
*Williams A. W.* Price Bubbles in Large Financial Asset Markets // Handbook of Experimental Economics Results / eds C. R. Plott, V. L. Smith. 2008. Vol. 1. P. 242–246.

Статья поступила в редакцию 5 декабря 2013 г.