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Laws Against Bubbles: an Experimental-Asset-Market Approach to Analyzing Financial Regulation

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LAWS AGAINST BUBBLES: AN EXPERIMENTAL-ASSET-MARKET APPROACH TO ANALYZING FINANCIAL REGULATION

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I. INTRODUCTION

Since the dramatic crash of the NASDAQ market in 2000, the idea of "bubbles" has permeated popular thinking about the economy. Journalists, economists, and policymakers have either warned of or refuted the existence of speculative bubbles in U.S. real estate,[1] the Chinese stock market,[2] the U.S. stock market (due to buyouts and private-equity investments),[3] and hedge funds.[4] "Bubble" has become a metaphor that seems to mean any volatile market in which prices have risen dramatically.[5] This metaphor has even entered judicial opinions. In one prominent case, a federal judge ruled that the collapse of a technology-stock-market bubble in 2000 was an intervening cause that precluded relief in a securities class-action suit.[6] Popular concerns over the existence of bubbles have meshed with concerns that excessive

1. Roger Lowenstein, *On the Homefront: Pop Psychology*, N.Y. TIMES MAG., Mar. 18, 2007, at 14 (comparing popular beliefs and the views of economists on whether U.S. real-estate markets are experiencing a bubble).

2. *See, e.g.*, David Barboza & Keith Bradsher, *Tax Increase Batters Chinese Stocks, but There's Little Wider Damage*, N.Y. TIMES, May 31, 2007, at C4 (reporting that the Chinese stock market plummeted in response to a new transaction tax designed to curb stock-market speculation "as a growing number of economists and analysts warn about the danger of a market bubble.").

3. *See, e.g.*, Andrew Ross Sorkin & Michael J. de la Merced, *Easy Credit Evaporates, and so Does the Market's Buyout Frenzy*, N.Y. TIMES, July 27, 2007, at C1 (reporting that a "buyout bubble," that is, speculation in takeovers and leveraged buyouts in the U.S. stock market, popped on July 26, 2007 as credit tightened); Shawn Tully, *Why the Private Equity Bubble is Bursting*, FORTUNE, Aug. 20, 2007, at 30–32, *available at* http://money.cnn.com/2007/08/06/markets/privateequitybubble.fortune/index.htm (analyzing the collapse of the "private equity bubble" that formed due to cheap credit and frenzied investors who were "dazzled by rich returns").

4. *See, e.g.*, Jenny Anderson, *How This Boom Differs from the Dot-Com Days: Hedge Funds Make Money*, N.Y. TIMES, July 6, 2007, at C5 (noting that money managers and the media have questioned since 2005 whether hedge-fund investments are in a bubble and that concerns have intensified with hedge funds preparing to make public offerings).

5. *See* Econbrowser, What Is a Bubble and Is This One Now?, http://www.econbrowser.com/archives/2005/06/what_is_a_bubbl.html (June 23, 2005, 23:43) (comparing popular analysis of whether there is a U.S. housing bubble to "Justice Potter Stewart's position on pornography—they haven't defined a bubble, but they think they know it when they see it").

6. *In re* Merrill Lynch & Co., 273 F. Supp. 2d 351, 364–65, 382 (S.D.N.Y. 2003). The decision also invoked the "bespeaks caution" doctrine to preclude relief for plaintiffs and again employed the bubble metaphor to do so. *Id.* at 376. For an analysis of this decision and its implications for the loss-causation element of securities-fraud litigation, see Jay W. Eisenhofer et al., *Securities Fraud, Stock Price Valuation, and Loss Causation: Toward a Corporate Finance-Based Theory of Loss Causation*, 59 BUS. LAW. 1419, 1438 (2004).

speculation and liquidity are causing severe mispricings in real-estate and securities markets and raising the risk of market crashes.[7]

But the popular and even judicial use of the word "bubble" lacks clarity and rigor, as do terms such as "excessive speculation" and "excessive liquidity." This imprecision may contribute to widespread misconceptions about whether and how markets misprice assets, particularly securities and real estate, and how the law should react to the potential for these mispricings. In fact, these misconceptions may influence the development of securities and financial laws as stock-market volatility generates calls for laws and regulations to remedy bubbles and reduce the potential for asset mispricings due to excessive speculation.[8] These proposals echo economic and legal scholarship that has advocated laws and policies to combat excessive speculation and thus improve the accuracy of asset pricing in financial markets.[9]

The following are recent examples of proposed and actual legal rules designed, at least in part, to prevent or prick bubbles, dampen the severity of "mispricing" during bubbles, or otherwise combat "excessive" speculation:

- In May 2007, the Chinese government imposed a tax on securities transactions to curb speculation in stocks as fears rose that the Chinese stock market was in a bubble.[10] This

7. *See, e.g.*, Chi Lo, *China's Slow but Sure Shift to Yuan Flexibility*, STRAITS TIMES (Sing.), Aug. 1, 2007 (reporting that "excessive liquidity" is driving asset-price inflation in the Chinese economy and "has boosted stock prices into bubble territory"); Floyd Norris, *A Mountain of Margin Debt May Not Be Cause for Concern*, N.Y. TIMES, Feb. 24., 2007, at C3 (reporting that high levels of margin investing in the stock market generated "concern of excessive speculation").

8. *See, e.g.*, Jad Mouawad, *Report on Amaranth Collapse Is To Be Made Public Today*, N.Y. TIMES, June 25, 2007, at C2 (reporting that a U.S. Senate subcommittee investigating the collapse of a hedge fund recommended that Congress "reinvigorate prohibitions against excessive speculation") (internal quotations omitted).

9. *See, e.g.*, Theresa A. Gabaldon, *John Law, with a Tulip, in the South Seas: Gambling and the Regulation of Euphoric Market Transactions*, 26 J. CORP. L. 225 (2001) (advocating the application of approaches from legal restrictions on gambling to regulation of financial speculation). Roberta Karmel provides a historical account of how combating excessive speculation was one of the key premises of federal securities laws. Roberta S. Karmel, *Mutual Funds, Pension Funds, Hedge Funds and Stock Market Volatility—What Regulation by the Securities and Exchange Commission Is Appropriate?*, 80 NOTRE DAME L. REV. 909, 935–37 (2005). Karmel argues that the SEC and the Federal Reserve had "regulatory tools for pricking" the technology-stock bubble of the late 1990s, particularly margin regulations, but failed to use these tools or otherwise address excessive speculation. *Id.* at 948. Frank Partnoy has addressed the broader topic of the role law can play in preventing market crashes, including crashes from speculative bubbles. Frank Partnoy, *Why Markets Crash and What Law Can Do About It*, 61 U. PITT. L. REV. 741 (2000).

10. Barboza & Bradsher, *supra* note 2, at C4.

action echoed economic scholarship advocating for transaction taxes to remedy excessive speculation.[11]

- Economic and legal scholars have long seen arbitrage[12] as a cure for speculative mispricings and as a means to short-circuit asset-price bubbles.[13] Scholars have advocated enabling arbitrage to perform these roles better by removing a Depression-era federal securities regulation that restricted short sales.[14] In June 2007, the Securities and Exchange Commission (SEC) repealed this restriction.[15]

- Scholars have also characterized "circuit breakers," which halt exchange trading after dramatic price declines, as a

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11. *See, e.g.*, Lawrence H. Summers & Victoria P. Summers, *When Financial Markets Work Too Well: A Cautious Case for a Securities Transactions Tax*, 3 J. FIN. SERVS. RES. 261 (1989) (positing that a transaction tax may curb excessive speculation that results from excess liquidity); Gabaldon, *supra* note 9, at 281 (advocating increasing short-term–capital-gains tax rates to curb investor gambling); Joseph E. Stigliz, *Using Tax Policy to Curb Speculative Short-Term Trading*, 3 J. FIN SERVS. RES. 101 (1989).

12. Arbitrage means investment trades that exploit a perceived short-term mispricing of an asset. For example, if an arbitrageur believes a certain stock is overvalued, he or she sells that stock short (i.e., borrows shares of that stock and then sells them). The arbitrageur profits if the stock price declines from the amount owed the lender of the stock (but loses if the price rises). Arbitrageurs hedge their risks when entering into short sales by simultaneously buying a close substitute of the stock. Andrei Shleifer & Robert W. Vishny, *The Limits of Arbitrage*, 52 J. FIN. 35 (1997) (analyzing how risks cannot be completely removed from arbitrage).

13. For a survey of the economic literature on the role of arbitrage (specifically short sales) in preventing asset-price bubbles and promoting the efficient pricing of stocks and an analysis of the legal restrictions on short sales, see Michael R. Powers et al., *Market Bubbles and Wasteful Avoidance: Tax and Regulatory Constraints on Short Sales*, 57 TAX. L. REV. 233 (2004).

14. *E.g.*, *id.* at 264, 270 (advocating repeal of the "uptick rule," which permitted short sales on a security only if the previous trade increased the price of that security). For a comprehensive analysis of the uptick rule, see Jonathan R. Macey et al., *Restrictions on Short Sales: An Analysis of the Uptick Rule and Its Role in View of the October 1987 Stock Market Crash*, 74 CORNELL L. REV. 799 (1989) (concluding that the uptick rule impairs market efficiency). The uptick rule is codified at 17 C.F.R. § 240.10a-1 (2007).

15. Regulation SHO and Rule 10a-1, 72 Fed. Reg. 36,348 (July 3, 2007) (to be codified at 17 C.F.R. pts. 240, 242). In enacting this rule change, the SEC stated that the benefits of removing this restriction would include improving the "price efficiency" of stock markets but did not explicitly reference the role of short sales in preventing asset-price bubbles. *Id.* at 36,355. Some scholars have noted that one of the historical purposes for the now-repealed uptick rule was to prevent bubbles. *See* ROBERT J. SHILLER, IRRATIONAL EXUBERANCE 226 (2001).

means of preventing excessive speculation and bubbles.[16] Other scholars have advocated reverse circuit breakers, which would halt trading after precipitous price gains, to quell excessive speculation.[17]

- Other scholars and policy makers have seen a role for enhanced securities-disclosure requirements in mitigating the risk of asset mispricings due to speculation and bubbles.[18]

Whether these legal measures work is open to question. This Article evaluates the effectiveness of laws, regulations, and policies designed to prevent asset-price bubbles, to prick bubbles that have occurred, or to reduce the severity of asset mispricings during bubbles—what this Article collectively labels "antibubble laws."

Economists generally define asset-price bubbles as the divergence of the price of an asset or asset class from its fundamental value,[19]

16. *See* SHILLER, *supra* note 15, at 225–26. The New York Stock Exchange initiated a circuit breaker after the 1987 stock-market crash. *See* NYSE, Inc., Rules and Constitution, Rule 80B (1998) ("Trading Halts Due to Extraordinary Market Volatility"). For background on the introduction of this circuit breaker and a proposal to modify the regulation to take into account how investors experience market time periods in "nonlinear" ways, see Lawrence A. Cunningham, *From Random Walks to Chaotic Crashes: The Linear Genealogy of the Efficient Capital Market Hypothesis*, 62 GEO. WASH. L. REV. 546, 598–602 (1994).

17. Gabaldon, *supra* note 9, at 283.

18. In 2003, a member of the Council of Economic Advisors framed a set of disclosure initiatives by the George W. Bush administration, which included a requirement that securities issuers provide investors with more quarterly information, as a means of mitigating the risk of asset-price bubbles and the "likelihood of asset mispricing." Randall S. Kroszner, *Asset-Price Bubbles, Information, and Public Policy*, *in* ASSET-PRICE BUBBLES: THE IMPLICATIONS FOR MONETARY, REGULATORY, AND INTERNATIONAL POLICIES 3, 10–12 (William C. Hunter et al. eds., 2003). Legal scholars have seen disclosure as one means to remedy excessive speculation and asset mispricings. *E.g.*, Gabaldon, *supra* note 9, at 283–84; Lynn A. Stout, *Are Stock Markets Costly Casinos?: Disagreement, Market Failure, and Securities Regulation*, 81 VA. L. REV. 611, 695–97 (1995) (positing that mandatory-disclosure rules discourage stock speculation by providing investors with uniform information that encourages homogeneous expectations).

19. *See, e.g.*, Robert P. Flood & Peter M. Garber, *Market Fundamentals Versus Price-Level Bubbles: The First Tests*, 88 J. POL. ECON. 745, 746 (1980); Henry T. C. Hu, *Faith and Magic: Investor Beliefs and Government Neutrality*, 78 TEX. L. REV. 777, 794 (2000). At times, economists have expanded this basic definition to include the reason that asset prices diverge from their fundamental values. Markus K. Brunnermeier, *Bubbles*, *in* THE NEW PALGRAVE DICTIONARY OF ECONOMICS (Steven Durlauf & Lawrence Blume eds., forthcoming 2008) (prepublication edition at 1, *available at* http://www.princeton.edu/~markus/research/papers/bubbles_survey.pdf)

which is generally defined as the present value of all future cash flows from an asset.[20] This Article considers the effectiveness of laws designed to combat the speculation that leads to such asset mispricings, and thus categorizes laws that purport to curb "excessive speculation" as antibubble laws.[21] But these definitions of bubble and fundamental value give rise to certain deep practical and theoretical problems that make identifying bubbles in real-world asset markets extremely difficult.[22] Moreover, the complexity of markets makes it difficult to untangle causal links between policy and effect using empirical evidence alone.[23]

Therefore, this Article argues that experimental asset markets serve as a crucial tool in evaluating the effectiveness of antibubble laws. These virtual markets allow researchers to create known fundamental values for securities and to test whether experimental subjects trade those securities at fundamental value.[24] Researchers have, through experimental controls, introduced market conditions or trading rules—many of which happen to mimic antibubble laws—to test whether these controls prevent or mitigate asset mispricings.[25]

Experimental and empirical evidence suggests that the effectiveness of antibubble laws in eliminating asset mispricings is highly questionable. These results, particularly from experimental evidence, suggest four additional conclusions. First, experimental

("Bubbles refer to asset prices that exceed an asset's fundamental value because current owners believe that they can resell the asset at an even higher price in the future.").

20. *See, e.g.*, Ellen R. McGrattan & Edward C. Prescott, *Testing for Stock Market Overvaluation/Undervaluation*, *in* ASSET-PRICE BUBBLES, *supra* note 18, at 271. One alternative to defining fundamental value in terms of future cash flows is to say that the best guess as to fundamental value is whatever the market price is. That tautology would make it impossible for prices ever to be "wrong."

21. Marcel Kahan characterizes these occurrences as "speculative mispricings." Marcel Kahan, *Securities Laws and the Social Costs of "Inaccurate" Stock Prices*, 41 DUKE L.J. 977, 990–92 (1992). As Kahan explains, stock prices may diverge from fundamental value for other reasons, such as insider trading and liquidity crunches. *Id.* at 988–93. This Article considers only divergences of asset prices from fundamental values—asset-price bubbles—that result from investor trading behavior. This Article also considers laws that address "excessive speculation" as antibubble laws, even if they are less than clear in articulating what constitutes "excessive speculation" or defining its harms.

22. *Infra* Part II.A.1.

23. *See* David P. Porter & Vernon L. Smith, *Stock Market Bubbles in the Laboratory*, 1 APPLIED MATHEMATICAL FIN. 111, 121–22 (1994).

24. Ronald R. King et al., *The Robustness of Bubbles and Crashes in Experimental Stock Markets*, *in* NONLINEAR DYNAMICS AND EVOLUTIONARY ECONOMICS 183, 183–85 (Richard H. Day & Ping Chen eds., 1993).

25. *E.g.*, *id.* at 185–86. The design of experimental asset markets is detailed in Part III.B.2.

evidence can assist in refining the economic theories on which many antibubble laws are based.[26] Using experiments to refine theory and shape experimental and empirical investigation represents a more nuanced approach to scholarship than a simple linear deduction of policy prescription from theory.

Second, both experimental and empirical evidence on antibubble laws suggest that asset-price bubbles are remarkably robust.[27] Some of the same evidence of market inefficiencies presented in this Article also undermines conclusions that legal intervention could remedy these inefficiencies.[28] This highlights a misconception that findings of market inefficiency, particularly from behavioral finance, necessarily support market interventions.[29]

This, in turn, leads to a third conclusion: experimental asset markets offer an underexploited tool for legal and economic scholars to evaluate the effectiveness of other securities and financial laws. Just as laboratory experiments in medicine complement epidemiological research, so too can experimental-asset-market research provide an invaluable complement to empirical legal scholarship on financial regulation.

Although experimental economics is not new to legal scholarship,[30] scholars have generally focused on basic economic experiments[31] and have given insufficient attention to more complex simulated financial markets. For example, path breaking work by 2002 Nobel Laureate Vernon Smith and other experimental-asset-market researchers has been

26. *See infra* Part III.C.1.A.

27. *See infra* Part III.C.

28. *See infra* Part III.C.

29. This conclusion is in line with the findings of Stephen Choi and Adam Pritchard. Stephen J. Choi & A.C. Pritchard, *Behavioral Economics and the SEC*, 56 STAN. L. REV. 1 (2003) (arguing for circumspection in using behavioral law and economics to justify regulation, as regulators suffer from similar cognitive biases as investors). Choi and Pritchard note that scholarship reviewing behavioral law and economics often has political undertones. *Id.* at 4.

30. One of the first articles that brought experimental economics to the attention of legal scholars was Elizabeth Hoffman & Matthew L. Spitzer, *Experimental Law and Economics: An Introduction*, 85 COLUM. L. REV. 991 (1985).

31. Legal scholars have focused on the legal implications of relatively simple experiments such as dictator and ultimatum games. In particular, legal scholars have looked to these experiments to explain the development of norms of reciprocity. *E.g.*, Cass R. Sunstein, *Social Norms and Social Roles*, 96 COLUM. L. REV. 903 (1996). Other scholars have looked at the implications of basic experiments for a wide range of legal fields. *See, e.g.*, Dan M. Kahan, *Reciprocity, Collective Action, and Community Policing*, 90 CAL. L. REV. 1513 (2002) (investigating implications of economic experiments and scholarship on development of social norms for community-policing efforts).

underexplored in the legal literature.[32] The difficulty of drawing policy conclusions from experimental asset markets may dissuade scholars. Indeed, experimental markets can generate conclusions only to the extent that their simplified attributes reflect the material characteristics of real markets.[33] But this Article attempts to provide a model for analyzing the validity and results of these experiments.

Finally, since most prophylactic antibubble rules appear ineffective, legal regimes should instead focus on ensuring the resiliency of markets to asset-price booms and crashes.[34]

This Article uses experimental-asset-market research as a tool to evaluate the effectiveness of laws designed to prevent, prick, or dampen the severity of asset-price bubbles. The Article creates a typology for these "antibubble laws" and interprets experimental research in virtual stock markets to question the effectiveness of these laws in eliminating asset mispricings during bubbles. This Article argues for greater use of experimental-asset-market research by legal scholars to evaluate the effectiveness of other financial regulations and provides a model for evaluating the validity of results from experimental asset markets.

Part II of this Article surveys the economic literature on asset-price bubbles. Section A describes several definitions of asset-price bubbles and highlights the embedded problems in these definitions, particularly how definitions of fundamental value are weakened by the realities of asset markets and potential logical circularity.

Section B presents the three principal families of microeconomic theories of bubbles: "rational bubbles," "irrational bubbles," and bubbles resulting from "heterogeneous expectations." Because legal prescriptions are often based on specific economic models, this Article examines the strengths and weaknesses of both theoretical families, particularly how problems embedded within the definitions of asset-price bubbles affect the performance of these models. This Section

32. This Article explores some of the groundbreaking work on asset-price bubbles in experimental asset markets, one of the key achievements for which Vernon Smith was awarded a Nobel Prize in 2002. Mike Lynch & Nick Gillespie, *The Experimental Economist*, 34 REASON, Dec. 2, 2002, at 34. A handful of legal scholars have referenced some of this research, usually in footnotes. *See, e.g.*, Thomas A. Lambert, *Overvalued Equity and the Case for an Asymmetric Insider Trading Regime*, 41 WAKE FOREST L. REV. 1045, 1053 n.25 (2006) (noting research on information efficiency of experimental stock markets); Henry G. Manne, *Insider Trading: Hayek, Virtual Markets, and the Dog that Did Not Bark*, 31 J. CORP. L. 167, 169 n.11 (2005) (same).

33. Vernon Smith calls this necessary condition for drawing implications from results of experimental economics "parallelism." Vernon L. Smith, *Microeconomic Systems as an Experimental Science*, 72 AM. ECON. REV. 923, 935–38 (1982) (outlining "precepts" for design of laboratory experiments in economics).

34. *Infra* note 327 and accompanying text.

focuses on the irrational-bubble theories generated by behavioral finance as this set of theories, despite the limitations described below, appears more robust than rational bubbles. Behavioral finance theories of bubbles also provide a broader template for understanding proposed and actual antibubble laws.[35]

Section C then introduces empirical evidence from behavioral finance of stock-market mispricings and investigates whether this evidence can be used to develop tests for the existence of bubbles. It also introduces evidence from experimental economics of the robustness of bubbles in experimental markets. Section D investigates whether the logic of behavioral finance applies to real-estate markets given the unique economic characteristics of real estate. Section E considers macroeconomic scholarship regarding the role of credit in the formation of bubbles.

Part III analyzes the effectiveness of laws designed to prevent, prick, or dampen bubbles. Section A traces how three elements of behavioral finance theory,[36] together with rules based on macroeconomic evidence regarding the role of credit in bubbles, serve as a template for understanding both proposed and existing antibubble laws. This Article creates a new typology for antibubble laws and categorizes them into four classes according to their method of addressing bubbles. Antibubble laws are thus designed to fulfill one of the following objectives:

1. *Provide enhanced information to investors on fundamental value of assets*, whereby laws require enhanced disclosure or investor education that aims to either focus investor attention on information regarding fundamental value rather than noise or remedy information asymmetries that lead to asset mispricing.

2. *Short circuit positive-feedback loops*, whereby laws attempt to break or dampen the positive feedback created when

35. Even policy prescriptions based on other models of bubbles fit roughly within this template and are evaluated in this Article with distinctions and different implications from behavioral finance. Behavioral finance scholars have explained bubble formation as the result of (1) investors trading on "noise" rather than fundamental information, due to cognitive limitations, mental shortcuts, and behavioral biases, which (2) lead investors to chase rising asset prices, creating positive-feedback loops that (3) cannot be corrected by arbitrageurs due to constraints on arbitrage. ANDREI SHLEIFER, INEFFICIENT MARKETS: AN INTRODUCTION TO BEHAVIORAL FINANCE 1–27 (2000) (providing an overview of behavioral finance theory organized as a response to the Efficient Market Hypothesis).

36. *See supra* note 35.

investors chase rising asset prices. This category includes transaction taxes, circuit breakers, and laws that attempt to either restrict investor access to certain markets or channel less sophisticated investors to less risky assets.

3. *Remove legal restrictions on arbitrage*, whereby legal initiatives would roll back restrictions to enable arbitrageurs to correct mispricings.

4. *Restrict credit to investors to curb speculation*, whereby laws would limit the provision of loans to investors (for example, margin regulations) or increase the cost of borrowing.

Section B argues that experimental asset markets are a critical tool in evaluating the effectiveness of these laws and articulates the general conditions for drawing conclusions from experimental evidence. Section C analyzes the experimental and empirical evidence of a range of antibubble laws following the four-part template outlined above and makes extensive notes on the limitations of specific pieces of experimental and empirical evidence.

Part IV moves beyond an analysis of the effectiveness of antibubble laws to consider their justification and justifiability. Section A. sketches the potential costs of asset-price bubbles to explain the reasons why policymakers consider antibubble laws. Recent public concern over bubbles is justified given the capacity of bubbles and the collapse of bubbles to cause: widespread misallocation of resources; reductions in market liquidity; epidemics of financial fraud; crises in investor confidence; and dramatic economic-spillover effects, including credit crunches, recession (or worse), and financial contagion into other markets and countries. Spillover effects go beyond affecting economic efficiency; collapsing bubbles can create severe inequities and social dislocation. Because of the potential costs of antibubble laws (outlined in Part IV.B), they should not be enacted without considering their effectiveness.

II. ECONOMIC THEORIES OF BUBBLES

Evaluating the effectiveness of laws designed to prevent, prick, or dampen the magnitude of asset-price bubbles must begin with an analysis of the economic theories that define bubbles and explain their formation.

A. Definitional Problems: Bubbles and Fundamental Value

1. THE BASIC DEFINITION: PRICE DEVIATION FROM FUNDAMENTAL VALUE

In the most widespread usage, economists define an asset-price bubble as a deviation in the price of a certain financial asset (or class of assets) from its fundamental value.[37] The fundamental value, according to most definitions in the economic literature, represents the present value of all future cash flows from that asset.[38] As an example, the fundamental value of a bond equals the present value of future payments of interest and principal on the bond with some discount for credit risk.[39]

This tidy example masks practical difficulties and several logical shortcuts. Two problems stand out. First, economists have calculated fundamental value for stocks and real estate by estimating future dividends and rental payments.[40] But many companies have adopted policies of retaining earnings rather than paying dividends,[41] and many real-estate owners cannot rent their property due to legal or practical restrictions.[42] For these assets, the only future cash flow is whatever

37. *See supra* note 19 and accompanying text. This definition has several advantages over a simpler definition used by other historians and economists. *See, e.g.*, CHARLES P. KINDLEBERGER, MANIAS, PANICS AND CRASHES: A HISTORY OF FINANCIAL CRISES 16 (4th ed. 2000) (defining a bubble as "an upward price movement over an extended range that then implodes"). Although this simpler definition captures the intuitive shape of a bubble, it fails to single out any causal explanation for the rise and crash of prices and thus cannot generate any testable hypotheses or predictions. Defining bubbles as a deviation in asset prices from fundamental value leads to the question of whether any divergence constitutes a bubble or whether prices must diverge to a pronounced extent and for a prolonged period.

38. *See supra* note 20 and accompanying text.

39. For a basic primer on bond valuation, see A. A. GROPPELLI & EHSAN NIKBAKHT, FINANCE 119–22 (5th ed. 2006).

40. *See, e.g.*, Kenneth A. Froot & Maurice Obstfeld, *Intrinsic Bubbles: The Case of Stock Prices*, 81 AM. ECON. REV. 1189 (1991) (developing a "rational-bubble" model for stocks using dividend payments as determinant of fundamental value); Charles Himmelberg et al., *Assessing High House Prices: Bubbles, Fundamentals, and Misperceptions* 1–2 (Nat'l Bureau of Econ. Research, Working Paper No. 11643, 2005) (using the "imputed annual rental cost" of owning property to determine the presence of a real-estate bubble).

41. Franklin Allen & Roni Michaely, *Payout Policy*, *in* 1A HANDBOOK OF THE ECONOMICS OF FINANCE, 408 (George M. Constantinides et al. eds., 2003) (describing the recent historic shift from corporations making payouts to stock investors in dividends to payouts in share repurchases).

42. For example, condominium-association governing documents often prohibit or restrict leasing. *See* Woodside Village Condominium Ass'n v. Jahren, 806 So. 2d 452, 453 (Fla. 2002) (upholding agreement restricting leases).

price a buyer will pay on sale, which makes defining fundamental value not only a speculative endeavor but potentially a circular one as well.[43]

Second, even measuring fundamental value solely on the basis of expected dividends or rental payments requires forecasting, and whether a forecast is reasonable is inescapably subjective. To evaluate the reasonableness of future-cash-flow estimations, economists resort to a host of different metrics that usually involve looking at historical patterns of the relationship between an asset's price and measures of an asset's income (e.g., company earnings).[44]

But reliance on historical patterns leads to the standard objection of disclosure boilerplate: past performance does not guarantee future results.[45] In other words, transformational economic changes—the introduction of a new technology or the opening of a new market—may create historically aberrant growth.[46] These transformational changes generate fantastic early market returns and lead investors to believe that historical ratios between an asset's prices and measures of its income might be obsolete.[47]

43. Logically, the greater the proportion of the income (either expected or possible) from the sale of an asset to the income from dividend or rental streams, the more speculative (in every sense of that word) the fundamental value of the asset becomes (unless the variance in the sales price is less than the variance of dividend and rental income from the assets).

44. SHILLER, *supra* note 15, at 180–83 (investigating the link between stock dividends, prices, and bubble theories).

45. SEC regulations require this disclosure on advertising by investment companies that include performance data. 17 C.F.R. § 230.482(b)(3)(i) (2007).

46. In fact, many scholars trace the formation of bubbles to widespread adoption of new technologies (e.g., the first financial exchanges in the seventeenth century, railroads in the nineteenth century, radios and airplanes in the 1920s, and the internet in the 1990s), social changes (e.g., the end of wars), or the opening of new geographical markets. KINDLEBERGER, *supra* note 37, at 38–41.

47. These beliefs represent what economist Robert Shiller calls "new era thinking." SHILLER, *supra* note 15, at 96. Many adherents to new era thinking, such as investors in technology stocks in the late 1990s, could justify their decisions only with what one economist labels "wildly optimistic expectations of sustained profit growth rates." Allan H. Meltzer, *Rational and Nonrational Bubbles*, *in* ASSET-PRICE BUBBLES, *supra* note 18, at 23, 27–28. But, demarcating when the flavor of reasonable risk taking becomes the poison of wild optimism is unavoidably subjective. The question of whether any particular current or historical asset market was in an asset bubble is beyond the scope of this Article. For an extended argument that the 1990s technology stock market was a bubble, see William O. Fisher, *Does the Efficient Market Theory Help Us Do Justice in a Time of Madness?*, 54 EMORY L.J. 843 (2005).

2. CONFLATION OF RISK AND UNCERTAINTY

When judging whether bubbles have formed with historical benchmarks, economists essentially use history to turn risk (randomness with known probabilities) into a proxy for uncertainty (randomness with unknown probabilities). These economists assume that the fundamental value of an asset will track certain measures of income from that asset according to known historical patterns. If prices of an asset diverge from these historical patterns, one explanation is that a bubble has formed because investors are miscalculating historical probabilities and thus miscalculating risk.[48] But history is not a certain guide to asset-price movements. Investors looking into the future face unknown probabilities of gain or loss on their investments; they are not playing dice.[49] Much of the empirical and experimental research that documents the bounded rationality of investors and underlies behavioral-finance theories of bubbles[50] likewise demonstrates the inability of investors to calculate and make decisions under known probabilities (i.e., risk) rather than make inadequate decisions under true uncertainty.

In order to evaluate theories and evidence of bubbles and policies to prevent, prick, or dampen their magnitude, it is critical to be explicit when risk is being used as a proxy for uncertainty; to evaluate, if possible, how well the proxy fits; and to consider how use of this proxy may affect definitions, tests, and policy prescriptions.

3. REFINEMENTS: ASSET PRICES AND FUNDAMENTAL INFORMATION

Some economists define a bubble in terms of the information on which investors trade; bubbles are thus "unsustainable increases" in asset prices caused by investors trading on a pattern of price increases rather than information on fundamental values.[51] The economists who use this definition challenge the Efficient Markets Hypothesis (EMH), which, even in its weak form, holds that investors cannot earn superior risk-adjusted returns using information the market already knows, such as the past prices of assets.[52]

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48. *See* Meltzer, *supra* note 47, at 28–29. This distinction between risk and uncertainty was first made by Frank Knight. *See* FRANK H. KNIGHT, RISK, UNCERTAINTY AND PROFIT 19–20 (1921).

49. Meltzer, *supra* note 47, at 28–29.

50. *See infra* Part II.B.2.

51. SHLEIFER, *supra* note 35, at 154.

52. For an overview of the EMH and the challenge it faces from behavioral finance, *see id.* at 5–23. For a seminal work in legal literature on the implications of this challenge for those securities regulations and doctrines based on the EMH, see Donald C. Langevoort, *Theories, Assumptions, and Securities Regulation: Market*

But the difficulties with defining fundamental value outlined above also plague efforts to define what constitutes information on fundamental value. To prove the existence of a bubble under this definition requires economists to preclude that information relied on by investors was related to fundamental value.[53] As noted below,[54] behavioral finance has identified several examples of stock-price movements that cannot easily be explained by information on fundamentals.[55]

4. DISPUTES ON HISTORICAL BUBBLES

Using any of these definitions, economists have made careers out of disputing whether or not historical financial manias and crashes constituted bubbles. Even canonical bubbles, such as the seventeenth-century Dutch Tulipmania,[56] the U.S. stock market circa 1929,[57] and the NASDAQ technology stock bubble in the late 1990s,[58] have been

Efficiency Revisited, 140 U. PA. L. REV. 851 (1992). For the seminal article introducing the EMH to legal literature, see Ronald J. Gilson & Reinier H. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549 (1984).

53. *E.g.*, Burton G. Malkiel, *The Efficient Market Hypothesis and Its Critics*, 17 J. ECON. PERSP., Winter 2003, at 59 (questioning whether behavioral finance meets this standard).

54. *See infra* Part II.C.1.

55. Furthermore, legal scholars have noted that, in its strict sense, the EMH only contends that market prices reflect all available information regarding an asset and not that prices necessarily reflect that asset's fundamental value. *See, e.g.*, Jeffrey N. Gordon & Lewis A. Kornhauser, *Efficient Markets, Costly Information, and Securities Research*, 60 N.Y.U. L. REV. 761, 766–71 (1985) (drawing a distinction between arguments that markets are characterized by speculative (i.e., informational) efficiency and those discussing allocational efficiency). Despite this distinction, the economic literature on bubbles often appears to conflate informational and allocational efficiency. *See, e.g.*, Nicholas C. Barberis & Richard H. Thaler, *A Survey of Behavioral Finance*, *in* 1B HANDBOOK OF THE ECONOMICS OF FINANCE, *supra* note 41, at 1054, 1056 (defining "fundamental value" as "the discounted sum of expected future cash flows" where investors are operating with all available information).

56. *Compare* Peter M. Garber, *Tulipmania*, 97 J. POL. ECON. 535 (1989) (arguing that prices of tulip bulbs during Dutch tulipomania in 1630s may have been justified by fundamentals), *with* EDWARD CHANCELLOR, DEVIL TAKE THE HINDMOST: A HISTORY OF FINANCIAL SPECULATION 23–26 (1999) (disputing Garber's facts and analysis).

57. *Compare* McGrattan & Prescott, *supra* note 20, at 271–75 (presenting evidence that the 1929 U.S. stock market was not overvalued), *with* Peter Rappoport & Eugene N. White, *Was There a Bubble in the 1929 Stock Market?*, 53 J. ECON. HIST. 549 (1993) (finding evidence that a bubble contributed to the 1920s stock-market boom and crash despite certain econometric tests that suggest no bubble existed).

58. *Compare* Lubos Pastor & Pietro Veronesi, *Was There a NASDAQ Bubble in the Late 1990's?*, 81 J. FIN. ECON 61 (2006) (presenting evidence that there was not

the subject of contrarian interpretations that market prices during these financial frenzies were indeed justified by fundamentals.

These debates illuminate the definitional problems outlined above and tend to break down along the lines of whether economists believe that investors are rational actors and the EMH holds or whether they believe that the rationality of investors is bounded and the stock market is less than efficient. This schism[59] has generated two different models for how bubbles form—rational-bubble models,[60] and behavioral-finance models of bubbles.[61]

This schism also highlights both sides of a logical trap. On the one side, finding that a bubble existed in the past, only after "future" cash flows have become historical fact because past prices did not pan out, creates the risk of hindsight bias.[62] On the other side, there is the risk of tautology. Unless theoretical conditions of irrationality in the marketplace can be identified, rational expectations and efficient markets may revert to unfalsifiable articles of faith rather than hypotheses that can be tested. Claims of market efficiency would also have to respond to any patterns of asset-price movements that would violate the keystone of the EMH that asset prices exhibit a random walk.[63]

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a NASDAQ bubble), *with* SHILLER, *supra* note 15, at 3–4 (arguing that the late 1990s market for technology stocks was overvalued).

59. *See infra* Part II.B.2.

60. *See infra* Part II.B.1.

61. *See infra* Part II.B.2. This Article follows the classification system for bubble models found in Brunnermeier, *supra* note 19, at 2.

62. Scholars often look back and see risk, but investors of the past looked forward into uncertainty. Robert J. Shiller, *Bubbles, Human Judgment, and Expert Opinion* 12–13 (Yale Cowles Found., Discussion Paper No. 1303, 2001), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=275515. Only examples of investor behavior that, *at the time*, could not be squared with rational expectations or fundamental information on the value of assets would support findings of investor irrationality. *See* Kenneth L. Fisher & Meir Statman, *Cognitive Biases in Market Forecasts*, 27 J. PORTFOLIO MGMT. 72, 78–79 (2000) (evaluating behavioral finance and other research for hindsight bias in market forecasts). Only comparisons of ultimate cash flows to historical price changes that show that investors make *systematic* errors (under- or overestimating cash flows or under- or overreacting to information) weaken support for market efficiency. Many behavioral-finance scholars recognize this and produce evidence of systematic errors. *See, e.g.*, Josef Lakonishok, *Contrarian Investment, Extrapolation and Risk*, *in* II ADVANCES IN BEHAVIORAL FINANCE 273, 312–13 (Richard H. Thaler ed., 2005) (responding to criticisms of "data snooping" with evidence of a "systematic pattern of expectational errors" by investors).

63. In fact, behavioral finance has offered evidence of systematic patterns in the marketplace that do not accord with a random walk and has identified examples of market mispricings that indicate investors were not trading on fundamental information. *See infra* Part III.C.1.

B. Microeconomic Models of Bubbles

1. RATIONAL BUBBLES

Scholars working within neoclassical economics have long attempted to create models of asset-price bubbles that assume investors have rational expectations.[64] Rational bubbles are generally defined as self-fulfilling prophecies created by rational expectations of higher prices.[65] Often, rational-bubble models have been used to argue that asset-price bubbles cannot exist because either investor rationality would prevent prices from ever departing from fundamentals[66] or bubbles would grow ad infinitum.[67]

Other scholars have used the circularity in this logic to launch trenchant critiques of rational-bubble models. These critics claim that rational-bubble models offer no explanation of how bubbles could ever begin,[68] are extremely unrobust to small changes in model assumptions,[69] and generate mathematically indeterminate solutions.[70] Most devastatingly, these scholars argue that rational-bubble theorists have failed to offer any empirical evidence of rational bubbles occurring in the real world.[71]

Some economists have attempted to rectify the first criticism (i.e., rational models offer no explanation of how bubbles begin) by tweaking

64. *See, e.g.*, Oliver Jean Blanchard, *Speculative Bubbles, Crashes and Rational Expectations*, 3 ECON. LETTERS 387, 387 (1979).

65. *See* Robert P. Flood & Robert J. Hodrick, *On Testing for Speculative Bubbles*, 4 J. ECON. PERSP., Spring 1990, at 85, 86.

66. *See, e.g.*, Jean Tirole, *On the Possibility of Speculation Under Rational Expectations*, 50 ECONOMETRICA 1163, 1179–80 (1982). Tirole bases this argument on the logic of general equilibrium that, if an initial price is efficient and everyone in the market is informed of that efficiency, no rational buyer would pay more than that price. *Id.*

67. Brunnermeier, *supra* note 19, at 5.

68. Meltzer, *supra* note 47, at 24.

69. Small changes in the assumptions of the rational-bubble models cause them to fail to generate bubbles. M. C. Adam & A. Szafarz, *Speculative Bubbles and Financial Markets*, 44 OXFORD ECON. PAPERS 626, 634 (1992).

70. Equations underlying rational-bubble models have mathematically indeterminate solutions. *Id.* at 636. This theoretical indeterminacy, in turn, leads to inconsistent empirical analysis. One pair of critics notes that "researchers working with the same data base and identical models will not necessarily detect the 'same' bubbles." *Id.* at 638. Moreover, rational-bubble models can generate an infinite number of price patterns, which bear no resemblance to the intuitive "shapes" of bubbles—either the prolonged rise in asset prices or the subsequent sharp crash. *Id.*

71. Meltzer, *supra* note 47, at 24.

their models to assume informational asymmetries between investors.[72] Essentially, sellers who realize prices may rise above fundamental values sell to purchasers who lack this information.[73] But even asymmetric rational bubbles have several limiting assumptions, most notably that arbitrage—and specifically short selling—must face constraints.[74] Even if rational-bubble theories have severe limitations, they offer one crucial insight that can contribute to more robust models of bubbles: once a bubble has formed and the expectations of investors drive asset prices higher, it may be perfectly rational for other investors to join in bidding prices higher and, in some cases, irrational and costly not to do so.[75]

2. BEHAVIORAL-FINANCE MODELS OF BUBBLES

Behavioral finance picks up on this insight by explaining that bubbles form because of the herd behavior, or positive-feedback behavior, of investors. But behavioral finance departs from the view of neoclassical economic finance that investors are rational actors. Instead, behavioral finance describes the rationality of investors as "bounded," and behavioral-finance models of bubbles argue that it is this departure from perfect rationality that sparks the initial inflation of a bubble.[76]

According to the logic of neoclassical finance that undergirds the EMH,[77] the mispricings of a bubble cannot occur for the following three reasons: (1) investors invest and trade in the capital markets in a rational manner; (2) any irrational trades are random and cancel each

72. *See, e.g.*, Franklin Allen & Gary Gorton, *Churning Bubbles*, 60 REV. ECON. STUD. 813 (1993).

73. Franklin Allen & Douglas Gale, *Bubbles and Crises*, 110 ECON. J. 236, 236 (2000). Theorists have elaborated on this basic model by explaining how agency costs contribute to bubble formation. They posit that bubbles form when banks that cannot perfectly monitor their borrowers' activities over-lend money to entrepreneurs who invest in risky assets and are underdeterred by the risk of default because of the limited liability of the corporate form. Franklin Allen & Douglas Gale, *Asset-Price Bubbles and Stock Market Interlinkages*, in ASSET-PRICE BUBBLES, *supra* note 18, at 323, 325–29.

74. Franklin Allen et al., *Finite Bubbles with Short Sale Constraints and Asymmetric Information*, 61 J. ECON. THEORY 206 (1993). Asymmetric rational bubbles also depend on two additional assumptions. First, before a bubble begins an asset's price equals its fundamental value, and initial purchasers cannot be aware that the price equals fundamental value. *See* Brunnermeier, *supra* note 19, at 9–10. Second, for the bubble to persist, this information asymmetry must also persist; subsequent trading cannot reveal to purchasers that prices have exceeded fundamental value. Allen et al., *supra*.

75. SHLEIFER, *supra* note 35, at 156–68.

76. *See* Brunnermeier, *supra* note 19, at 10.

77. *See supra* notes 52–53 and accompanying text.

other out; and (3) arbitrage corrects any remaining irrational trading not cancelled out.[78] Behavioral finance counters each of these assumptions in turn.

a. Bounded rationality and noise traders

Behavioral finance's first line of attack on neoclassical finance and the foundation for its explanation of how asset-price bubbles form is that many investors do not exhibit perfect rationality in making investment decisions.[79] Behavioral finance argues that many investors do not: (1) gather optimal information to evaluate the fundamentals of assets; (2) carefully calculate probabilities and risk; and (3) make decisions that maximize their self-interest.[80] Instead, behavioral finance argues that many unsophisticated investors trade on "noise"—information not related to assessing the fundamental value of assets.[81] These "noise traders" evaluate whether to buy or sell assets based on price trends,[82] emotions,[83] or estimations about what other investors in the market will do.[84]

Unsophisticated investors trade on noise, according to behavioral finance, because their decision making is marred by behavioral biases.[85] Behavioral finance draws on extensive experimental literature from the fields of social psychology and the cognitive sciences, now well explored by the legal academy, [86] that shows individuals use mental

78. Gilson & Kraakman, *supra* note 52, at 579–88.

79. SHLEIFER, *supra* note 35, at 10–12 (summarizing principle behavioral finance research that investors are not "fully rational"); Barberis & Thaler, *supra* note 55, at 1065–69.

80. Barberis & Thaler, *supra* note 55, at 1065–74.

81. *See* Donald C. Langevoort, *Taming the Animal Spirits of the Stock Markets: A Behavioral Approach to Securities Regulation*, 97 NW. U. L. REV. 135, 139–52 (2002) (surveying noise-trader research in economic literature).

82. Robert J. Shiller, *Stock Prices and Social Dynamics*, 2 BROOKINGS PAPERS ECON. ACTIVITY 457 (1984).

83. For an analysis of how emotions affect the decisions of investors, see Peter H. Huang, *Regulating Irrational Exuberance and Anxiety in Securities Markets*, *in* THE LAW AND ECONOMICS OF IRRATIONAL BEHAVIOR 501, 505–18 (Francesco Parisi & Vernon L. Smith eds., 2005).

84. *See generally* Robert J. Shiller, *Fashions, Fads, and Bubbles in Financial Markets*, *in* KNIGHTS, RAIDERS AND TARGETS 56 (John C. Coffee, Jr. et al. eds., 1988).

85. Behavioral finance builds off evidence that individuals often exhibit preferences that skew how investors evaluate risky gambles. Barberis & Thaler, *supra* note 55, at 1069–75.

86. For an introduction to the now-extensive literature on behavioral law and economics, see Christine Jolls et al., *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471 (1998). For a discussion of behavioral biases leading to the

shortcuts, called "heuristics," to process information and make complex economic decisions.[87] These heuristics lead to systematic behavioral biases in the perception of risk, including overoptimism,[88] overconfidence,[89] and the availability bias.[90] According to behavioral finance scholarship, during an extended market boom with conspicuous gains by early investors, these biases and other biases cause investors to conclude that rising prices will continue.[91] Moreover, investors conclude that they will profit handsomely from flipping assets and that they will be able to sell before a price downturn due to superior skill.[92]

b. Herding and positive-feedback investment loops

Second, behavioral finance presents evidence that refutes the second contention of neoclassical scholars. Instead of canceling each other out, noise traders reinforce each other because bounded rationality and behavioral biases cause highly correlated and mutually reinforcing—rather than random—investment decisions.[93] Behavioral finance presents evidence that investors are influenced by social

formation of stock-market bubbles, see Werner De Bondt, *Bubble Psychology*, *in* ASSET-PRICE BUBBLES, *supra* note 18, at 205, 210–12.

87. Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCI. 1124 (1974).

88. Overoptimism in the context of investing describes how noise traders possess an overly optimistic view of their good fortune in a stock market. *See, e.g.*, J. Bradford De Long & Andrei Shleifer, *The Stock Market Bubble of 1929: Evidence from Closed-end Mutual Funds*, 51 J. ECON. HIST. 675, 697 (1991) (concluding that over-optimism of investors contributed to the 1929 stock-market bubble).

89. Overconfidence in the context of investing describes how noise traders overestimate their own ability to predict stock-market fluctuations and time their exit before a crash. *See* J. Bradford De Long et al., *The Survival of Noise Traders in Financial Markets*, 64 J. BUS. 1, 5 (1991) (arguing that the overconfidence bias leads noise traders to remain in the market despite a risk of severe losses). Behavioral economists have presented substantial empirical evidence that individuals exhibit overoptimism in judging the probability of good outcomes and are overconfident in their own abilities, including their ability to estimate probabilities. *See* Barberis & Thaler, *supra* note 55, at 1065–66.

90. The availability bias describes how more recent or salient events tend to overinfluence an individual's estimates of probabilities. *See* Tversky & Kahneman, *supra* note 87, at 1127–28.

91. Conversely, the remoteness of the last crash or market downturn causes investors to discount the possibility of incurring heavy losses. Richard J. Herring & Susan Wachter, *Real Estate Booms and Banking Busts: An International Perspective* 99–127 (The Wharton Fin. Insts. Ctr., Working Paper, 1999) (on file with author); *see also* J. Bradford De Long et al., *Positive Feedback Investment Strategies and Destabilizing Rational Speculation*, 45 J. FIN. 379, 383 (1990) (questioning why noise traders do not learn from previous bubbles).

92. *See* De Bondt, *supra* note 86, at 208–09.

93. *See* SHLEIFER, *supra* note 35, at 11–12.

dynamics and thus engage in herd behavior, follow fads, and chase trends.[94]

Behavioral finance places this behavior in a larger rubric of "positive-feedback investment strategies."[95] If prices of an asset rise, investors who pursue these strategies bid prices higher as they base their analysis on the asset-price trend.[96] The resulting rise in prices further increases demand among these noise traders, and a feedback loop develops.[97]

c. Limited arbitrage

Betting against noise traders in the middle of a positive-feedback loop can prove perilous. This points to the third response of behavioral finance to neoclassical economics: arbitrage may not correct deviations from fundamental value because arbitrageurs face severe limitations in attempting to exploit the mispricings caused by noise traders.[98] Many legal and economic scholars focus on legal limitations on arbitrage, notably short-sale restrictions.[99]

But arbitrageurs also face various forms of economic risks. First, arbitrageurs face a "fundamental risk," which is the risk that future news about a company may drive the prices against the arbitrageur's position.[100] Second, arbitrageurs face "noise-trader risk," which is the risk that noise traders will drive the prices further away from fundamental values.[101] This risk becomes pronounced if a period of

94. *Id.* at 12. *See* SHILLER, *supra* note 15, at 135–68 (outlining the psychological basis for investment decisions and the effect of herd behavior on capital markets); Shiller, *supra* note 82, at 457 (arguing that investors make decisions because of social and behavioral factors rather than through rational, self-interested calculations).

95. *See* SHLEIFER, *supra* note 35, at 154–55.

96. *Id.* at 155–56. Again, economists consider price-trend-information noise rather than information about the fundamental value of the asset.

97. For a model of this feedback loop, see *id.* at 158–68.

98. *See* Barberis & Thaler, *supra* note 55, at 1058–59.

99. *See, e.g.*, Powers et al., *supra* note 13.

100. *See* Barberis & Thaler, *supra* note 55, at 1058–59. Hedging by buying or selling substitute stocks cannot completely remove this risk given the rarity of perfect substitutes. *Id.*; SHLEIFER, *supra* note 35, at 14. In addition, substitute stocks may themselves be mispriced, which is more likely in periods of systematic mispricing, such as bubbles. Barberis & Thaler, *supra* note 55, at 1058 n.4. No substitutes exist for stocks or bonds as a whole, making arbitrage against market-wide mispricing impossible. SHLEIFER, *supra* note 35, at 13. Andrei Shleifer describes the huge losses that would have threatened an arbitrageur attempting to sell short during the apparent stock-market-wide overvaluation of the late 1990s. *Id.* at 15–16.

101. J. Bradford De Long et al., *Noise Trader Risk in Financial Markets*, 98 J. POL. ECON. 703, 705 (1990).

prolonged investor irrationality begins.[102] Arbitrageurs who aim to exploit (and thus correct) mispricings may be unable to outlast noise traders.[103] Noise trading could be countered by the combined resources of several arbitrageurs, but arbitrageurs face a final risk—collective-action failure.[104]

In contrast to neoclassical theory, arbitrageurs with superior information may have a strong incentive to trade ahead of, not against, noise traders.[105] Arbitrageurs who adopt this strategy can reap enormous profits and then liquidate their positions before noise traders reverse course. Strong empirical evidence indicates that arbitrageurs in fact behave in this manner, exacerbating the severity of mispricing caused by noise trading.[106]

102. *See* SHLEIFER, *supra* note 35, at 15–16 (describing the noise-trader risk faced by arbitrageurs attacking apparent overvaluation during the technology bubble).

103. Arbitrageurs enjoy neither unlimited resources nor infinite time horizons. Shleifer & Vishny, *supra* note 12, at 38–43. Most arbitrageurs have short horizons because they are managing the money of other investors; this creates a classic agency problem. If an arbitrageur loses considerable money in the short-run trading against noise, investors and creditors may view this as a sign of the arbitrageur's incompetence and threaten to withdraw funds or loans, forcing the arbitrageur to liquidate positions prematurely. *Id.* Arbitrageurs may be unable to outlast noise traders; economists have shown that, contrary to the assumptions of the EMH, noise traders can persist in financial markets for extended periods. *See generally* De Long & Shleifer, *supra* note 88 (arguing that the overconfidence bias leads noise traders to remain in the market despite a risk of severe losses). The risks arbitrageurs face in betting against irrational investors are not just theoretical. The Tiger Fund—perhaps the most prominent fund that refused to bet against technology stocks in the late 1990s by refusing to invest in them—suffered heavy losses and was forced to close in March 2000, mere months before the peak of the NASDAQ. Markus K. Brunnermeier & Stefan Nagel, *Hedge Funds and the Technology Bubble*, 59 J. FIN. 2013, 2030–32 (2004). Furthermore, even if a market crash wipes out noise traders, a new generation of noise traders could enter the market in time for a new bubble. This real possibility counters the argument of some proponents of the EMH that the bursting of one bubble precludes future episodes of irrationality. *See* Lynn A. Stout, *The Mechanisms of Market Inefficiency: An Introduction to the New Finance*, 28 J. CORP. L. 635, 666 (2003).

104. Other arbitrageurs may not similarly trade against noise because of different information. *See* Dilip Abreu & Markus K. Brunnermeier, *Synchronization Risk and Delayed Arbitrage*, 66 J. FIN. ECON. 341, 343 (2002) (labeling this risk of collective action failure as "synchronization risk"). Coordinated action is limited by the threat of defection and legal constraints. *See id.*

105. SHLEIFER, *supra* note 35, at 169, 172.

106. *See* Brunnermeier & Nagel, *supra* note 103, at 2014–16.

d. A behavioral-finance model of asset-price bubbles

One behavioral-finance scholar connects these elements of behavioral finance in a simple model of how bubbles form.[107] First, a "displacement"—either an external macroeconomic or political event or good news about a specific industry—causes corporate profits to rise. Investors with superior information make conspicuous gains as share prices rise. Noise traders, attracted by rising prices, enter the market and bid prices even higher, adopting positive-feedback investment strategies. Informed investors and arbitrageurs (known as "smart money") anticipate noise-trader demand and bid-up prices in advance of noise traders, further stimulating demand. When smart money senses the market overheating, it sells. Ultimately, noise traders follow and, once a tipping point is reached, prices crash.[108]

3. HETEROGENEOUS-EXPECTATIONS MODELS OF BUBBLES

A number of economists have created a third set of theories for how bubbles develop that resembles, in certain respects, the work of behavioral finance. This third set of models posits that bubbles form due to the fact that investors have heterogeneous beliefs about the future market prices compared to the homogenous beliefs assumed by neoclassical economics.[109] Under many of the models in this third family, the divergence of investor beliefs stems from psychological biases, but all of these models include limitations on short selling.[110] Heterogeneity of investor beliefs or expectations can lead to price inflation as optimistic investors bid prices up while more pessimistic investors cannot sell short because of arbitrage limitations.[111]

C. Evidence of Mispricings

1. EMPIRICAL EVIDENCE OF ANOMALIES AND TESTS FOR BUBBLES

Behavioral-finance scholars back up their theoretical challenge to neoclassical finance and the EMH with empirical evidence of stock-market mispricings, that is, examples of various pricing anomalies in capital markets that violate the tenets of investor rationality and the

107. SHLEIFER, *supra* note 35, at 169–75.

108. *Id.* at 169–75.

109. Lynn A. Stout, *Why the Law Hates Speculators*, 48 DUKE L.J. 701, 755–62 (1999) (describing this set of models).

110. Brunnermeier, *Bubbles*, *supra* note 19.

111. *Id.*

EMH.[112] Phenomena, such as the closed-end fund puzzle,[113] the twin-share anomaly,[114] the IPO carve out,[115] and Internet-name anomalies,[116] represent instances in which either certain stock prices could not have reflected fundamental value or investors could not have been trading on fundamental information. Economists consider these anomalies evidence of "investor sentiment."[117]

These anomalies may serve as indicia of the existence of stock-market bubbles and add to the set of imperfect tools for detecting bubbles.[118] But serious questions remain as to whether anomalies indicate broader market mispricings or are merely isolated curiosities.[119] Phrased differently, does evidence of investor sentiment equate with evidence of asset-price bubbles?[120] Economists are working to develop other tools for detecting bubbles, such as investor surveys,[121] but evidence from anomalies and other tools often points in contrary

112. Barberis & Thaler, *supra* note 55, at 1061–64; SHILLER, *supra* note 15, at 179–80.

113. The prices of certain mutual funds have occasionally risen far above the net asset value of the fund, even after adjusting for tax and other considerations. This means that investors are paying more for shares in a fund than they would pay if they purchased the proportionate share of the stocks in that fund's portfolio. *See* De Long & Shleifer, *supra* note 88, at 697 (recognizing that this phenomenon existed in the late 1920s).

114. This anomaly occurs when a given security is traded on two different markets, but the prices in those markets diverge over an extended period of time. *See* Barberis & Thaler, *supra* note 55, at 1061–63 (explaining the twin-share anomaly and noting how arbitrageurs theoretically could exploit it).

115. After 3Com sold five percent of its shares of Palm in an initial public offering, Palm's stock price paradoxically rose above the implicit price of its parent, 3Com. This implied that, apart from its shareholdings in Palm, 3Com had a negative value. Owen A. Lamont & Richard H. Thaler, *Can the Market Add and Subtract?: Mispricing in Tech Stock Carve-Outs*, 111 J. POL. ECON. 227, 230–31 (2003) (documenting multiple examples of this anomaly).

116. During the recent technology-stock boom, researchers noted that shares of companies with ".com" in their name sold in public offerings for significantly higher prices statistically than those of comparable companies. Also, market news about certain companies would irrationally affect the prices of different companies with similar names or stock-market-ticker symbols. Yaron Brooks & Robert J. Hendershott, *Hype and Internet Stocks*, J. INVESTING, Summer 2001, at 53; Michael J. Cooper et al., *A Rose.com by Any Other Name*, 56 J. FIN. 2371, 2371–72 (2001).

117. Malcolm Baker & Jeffrey Wurgler, *Investor Sentiment in the Stock Market*, J. ECON. PERSP., Spring 2007, at 129, 129 (defining sentiment as "belief about future cash flows and investment risks that is not justified by the facts at hand").

118. *See* Robert J. Shiller, *From Efficient Markets Theory to Behavioral Finance*, J. ECON. PERSP., Winter 2003, at 83, 101–02.

119. *See, e.g.*, Malkiel, *supra* note 53.

120. *E.g.*, *id.*

121. *See, e.g.*, Robert J. Shiller, *Measuring Bubble Expectations and Investor Confidence* (Nat'l Bureau of Econ. Research, Working Paper No. 7008, 1999).

directions. Identifying historical bubbles, let alone determining whether markets are *currently* experiencing a bubble, remains more art than science.

2. CRITICISM OF BEHAVIORAL FINANCE: OPEN QUESTIONS

Critics of behavioral finance charge that behavioral finance offers a laundry list of cognitive biases but does not adequately specify the particular biases (or the relative role among biases) that lead to mispricings and bubbles.[122] Other scholars note that certain behavioral biases, such as the hot-hand[123] and gambler's[124] fallacies, run counter to one another.[125] Other biases, such as conservatism,[126] would work against positive-feedback loops by causing investors to discount recent price trends and overemphasize long-term price probabilities.

Moreover, behavioral finance has yet to fully flesh out an explanation of seller behavior during the rise of a bubble.[127] At least

122. Robert S. Chirinko, *Comments on: "Stocks as Money …" and "Bubble Psychology," in* ASSET-PRICE BUBBLES, *supra* note 18, at 231, 234–35 ("While reading the behavioral finance literature, one gets the feeling of being in a well-stocked supermarket with a multitude of psychological tendencies waiting to be plucked from the shelf to explain the NASDAQ decline and other financial market outcomes. . . . With a surplus of explanations, it is difficult to know how to evaluate and discriminate among behavioral theories.").

123. The hot-hand fallacy translates a phenomenon from the sports world where coaches and athletes believe that an individual's shooting streak will continue, despite the statistical evidence that the shooter is enjoying a streak of luck and his or her performance will revert to its long-term mean. Thomas Gilovich et al., *The Hot-Hand in Basketball: On the Misperception of Random Sequences*, 17 COGNITIVE PSYCHOL. 295 (1985). The hot-hand fallacy could lead to investors bidding up assets based on the erroneous belief that rising prices indicate a streak of their personal investing skill rather than chance or the development of a positive-feedback loop.

124. This fallacy refers to a common mistake that one random event can affect or be used to predict another random event. The canonical example is the erroneous belief that if a coin is flipped four times and lands "heads" each of those times, it has a greater than fifty percent probability of landing "tails" on the next flip. Amos Tversky & Daniel Kahnemann, *Belief in the Law of Small Numbers*, 76 PSYCHOL. BULL. 105, 106 (1971). In asset prices, the gambler's fallacy might lead an investor to conclude that a lucky streak of rising prices is about to end and cause him or her to sell, thus short-circuiting a positive-feedback loop.

125. Gregory La Blanc & Jeffrey J. Rachlinski, *In Praise of Investor Irrationality*, *in* THE LAW AND ECONOMICS OF IRRATIONAL BEHAVIOR, *supra* note 83, at 542, 556.

126. Conservatism describes mistakes in calculating probability due to the overweighting of base-rate probabilities and the underweighting of sample probabilities. Ward Edwards, *Conservatism in Human Information Processing*, *in* FORMAL REPRESENTATION OF HUMAN JUDGMENT 17, 17–18 (Benjamin Kleinmutz ed., 1968).

127. *See* Meltzer, *supra* note 47, at 28.

two explanations are possible. The first is a model with two groups—noise traders that buy and smart money that sells.[128] The second explanation involves noise traders rapidly flipping stocks among each other, with each trader overconfident that he or she knows better than his or her counterpart when a stock is under- or overvalued.[129]

These critiques of behavioral finance indicate open research questions, including the need to articulate which behavioral biases cause investor sentiment and asset mispricings, which types of investors suffer from which biases and to what degree, and when certain biases come to dominate opposing biases.[130]

3. ROBUSTNESS OF BUBBLES IN EXPERIMENTAL ASSET MARKETS

Although behavioral finance's theory and evidence of asset-price bubbles has been criticized, experimental economics offers supporting evidence by documenting the existence of asset-price bubbles in experimental asset markets.[131] These experimental markets buttress much of the theoretical and empirical work of behavioral finance by demonstrating how even relatively financially sophisticated investors can behave like noise traders in simulated stock markets.[132]

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128. *See, e.g.*, SHLEIFER, *supra* note 35, at 169–74; Weihong Huang & Richard H. Day, *Chaotically Switching Bear and Bull Markets: The Derivation of Stock Market Distributions from Behavioral Rules*, *in* NONLINEAR DYNAMICS AND EVOLUTIONARY ECONOMICS, *supra* note 24, at 169, 169–81 (modeling stock-market cycles as nonlinear results of the interaction of noise traders, investors trading on fundamental information, and market makers). This explanation would benefit greatly from further precision regarding the profiles of the investors who fall in each category and from an investigation into whether stocks become increasingly concentrated in the hands of noise traders. *See* Meltzer, *supra* note 47, at 26–28 (critiquing irrational-bubble models for failing to answer these questions).

129. In both explanations, further research is required to understand the mechanics of the tipping point between bubble and crash.

130. Gregory Mitchell argues that behavioral-law-and-economics scholarship has been impeded by its focus on "behavioral tendencies" and its failure to articulate the "boundary conditions" for those tendencies. Gregory Mitchell, *Tendencies versus Boundaries: Levels of Generality in Behavioral Law and Economics*, 56 VAND. L. REV. 1781 (2003). The difficulty in linking behavioral biases to mispricings (a "bottom-up approach") has led other economists to take a "top-down approach" and use clear statistical evidence of investor sentiment to identify types of securities more likely to suffer from sentiment. *See, e.g.*, Baker & Wurgler, *supra* note 117, at 130.

131. *See, e.g.*, Gunduz Caginalp et al., *Overreactions, Momentum, Liquidity, and Price Bubbles in Laboratory and Field Asset Markets*, 1 J. PSYCHOL. & FIN. MARKETS 24 (2000); King et al., *supra* note 24, at 183; Porter & Smith, *supra* note 23, at 111; Vernon L. Smith et al., *Bubbles, Crashes, and Endogenous Expectations in Experimental Spot Asset Markets*, 56 ECONOMETRICA 1119 (1988).

132. *E.g.*, Caginalp et al., *supra* note 131 (using experimental-asset-market results to create a "momentum model" explaining trader behavior).

Experimental economists have conducted sets of experiments in which subjects trade a fixed-income security with each other on a computer trading system over a set number of trading periods.[133] In these experiments, traders knew that the security would mature at the end of the last trading period and were informed of the probabilities that a fixed dividend would be paid at the end of every trading period. This means that there was a true fundamental value to the security (i.e., no Knightian uncertainty)[134] and that traders could calculate this value as of each trading period.[135] Yet traders repeatedly engaged in bidding wars that drove the prices of securities higher than fundamental values, with prices returning to fundamental value, often via crash, only in the last trading period.[136] Bubbles in these experimental markets have proven remarkably robust under various conditions.[137]

D. Real-Estate Bubbles

Much of behavioral-finance literature has focused on stock-market bubbles, which leads to the question of whether the same logic of irrational investors driving market mispricing applies to other asset classes, particularly real estate. Real-estate assets possess economic characteristics such as immobility,[138] durability,[139] heterogeneity,[140] and

133. *See, e.g.*, Caginalp et al., *supra* note 131, at 24; King et al., *supra* note 24, at 183; Porter & Smith, *supra* note 23, at 111; Smith et al., *supra* note 131, at 56.

134. *See supra* note 23 and accompanying text.

135. *See* Caginalp et al., *supra* note 131, at 24–25; David P. Porter & Vernon L. Smith, *Futures Contracting and Dividend Uncertainty in Experimental Asset Markets*, 68 J. BUS. 509, 509–10 (1995); Smith et al., *supra* note 131, at 1124.

136. Caginalp et al., *supra* note 131, at 26; King et al., *supra* note 24, at 199–200; Porter & Smith, *supra* note 23, at 121–22; Smith et al., *supra* note 131, at 1148–50.

137. *See* Caginalp et al., *supra* note 131, at 26–32 (surveying experiments where bubbles occurred despite various changes in experimental market conditions). For samples of experiments testing for the occurrence of bubbles under various economic conditions and policies, see King et al., *supra* note 24, at 185–200; Vivian Lei et al., *Non-speculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality vs. Actual Irrationality*, 69 ECONOMETRICA 831 (2001); Smith et al., *supra* note 131.

138. Real estate, by definition, cannot be moved from one location to another, which, in turn, influences the other economic properties of real estate discussed in this Section. MICHAEL BALL ET AL., THE ECONOMICS OF COMMERCIAL PROPERTY MARKETS 273 (1998) ("Partly because the investment is heterogeneous and immobile, no central trading market, equivalent to the stock market, has developed for property.").

139. Securities and the companies that issue them can terminate, but, barring cataclysm, land cannot be destroyed and buildings tend to have long lives. THOMAS W. SHAFER, REAL ESTATE AND ECONOMICS 29–30 (1975) ("The possibility of the market

consumability[141] that differ materially from securities. Because of these factors, real-estate assets are not fungible and real-estate markets are both fragmented—there are no central national markets for trading real-estate properties as there are for securities[142]—and prone to periods of disequilibrium.[143]

The factors promoting disequilibrium can be exacerbated by the same behavioral phenomena described in behavioral-finance theory. Although the connections to behavioral-finance theory remain underexplored, real-estate economists have begun to map out how heuristics, behavioral biases, herd behavior, and positive-feedback loops can drive mispricing in real-estate markets.[144] Moreover,

making necessary adjustments in the short run to take advantage of temporary and short-lived demand is reduced by the long life of real estate assets.").

140. The uniqueness of each piece of real estate generates information costs for purchasers, complicates pricing, and limits the availability of substitutes. BALL ET AL., *supra* note 138, at 273.

141. Real estate represents not only an investment good that can be leased or sold for a return, but also a consumption good used for work or living space; and investors often purchase a real-estate asset for both investment and consumption functions. *Id.* at 14.

142. *See supra* note 138.

143. Immobility means that supply of real estate in one physical location cannot be moved to meet greater demand in another area; people and businesses must move to real estate, which involves high transaction costs. *See* SHAFER, *supra* note 139, at 29–30. Durability means that the stock of housing cannot contract easily in periods of lower demand, creating the potential for gluts. *See id.* at 29. Heterogeneity contributes to higher information costs and information asymmetries. *See* BALL ET AL., *supra* note 138, at 273–74. Heterogeneity also makes hedging difficult by limiting the availability of close substitutes and increasing the transaction costs of purchasing real estate. *Id.* at 273. The high transaction costs of purchasing and selling real estate slow market corrections. In turn, the high costs of development delays the entry of new real-estate stock to meet demand. *Id.* at 15. Finally, the dual use of real estate for investment and consumption often leads individuals to "overinvest" in real estate by investing more money in a particular asset than can be recouped when selling the asset in the market. *See* Jan K. Brueckner, *Consumption and Investment Motives and the Portfolio Choices of Homeowners*, 15 J. REAL EST. FIN. & ECON. 159 (1997) (evaluating evidence of overinvestment due to the consumption value of real estate).

144. *E.g.*, Markus K. Brunnermeier & Christian Julliard, *Money Illusion and Housing Frenzies*, REV. FIN. STUD. (forthcoming 2007), *available at* http://www.princeton.edu/~markus/research/papers/money_illusion_housing_frenzies.pdf; Robert J. Shiller, *Historic Turning Points in Real Estate* (Crowles Found., Discussion Paper No. 1610, 2007), *available at* http://cowles.econ.yale.edu/P/cd/d16a/d1610.pdf); Grace Wong, The Anatomy of a Housing Bubble: Overconfidence, Media and Politics (Feb. 2007) (unpublished manuscript, *available at* http://real.wharton.upenn.edu/~wongg/research/bubble.pdf).

empirical research indicates that the EMH does not apply to real-estate markets.[145]

The unique properties of real-estate markets may worsen mispricings. For example, because real estate is not a common-value good and is not traded on a market, it is impossible to short sell individual real-estate properties, which means arbitrage cannot correct mispricings.[146] In addition, because of their unique economic characteristics, real-estate prices also exhibit rigidity or inflexibility ("stickiness"), particularly downward stickiness.[147] Downward stickiness has led some economists to analyze whether crashes may be delayed or whether certain real-estate bubbles do not crash but persist or slowly leak.[148]

E. Macroeconomic Research into the Role of Credit in Bubbles

Both the rational- and behavioral-finance models of bubbles are constructs of microeconomics. But there is also a long history of macroeconomic scholarship regarding bubbles that focuses on the role of credit in driving mispricings. This line of inquiry must be considered as either an alternative or a complement to microeconomic models. Otherwise, antibubble laws may miss important factors in bubble formation and target the wrong causes. In particular, macroeconomists have studied the effects of monetary policy and have noted a pattern that increasing interest rates have pricked asset-price bubbles, leading to price downturns.[149] Even macroeconomists who disagree about the wisdom of using monetary policy to control asset prices[150] agree that

145. Man Cho, *House Price Dynamics: A Survey of Theoretical and Empirical Issues*, 7 J. HOUSING RES. 145 (1996); Dean H. Gatzlaff & Doğan Tirtiroğlu, *Real Estate Market Efficiency: Issues and Evidence*, 3 J. REAL EST. LITERATURE 157 (1995).

146. But, due to the innovations of economists, it is also now possible to invest in real-estate futures contracts sold on the Chicago Mercantile Exchange. These futures contracts allow property owners and investors to hedge against potential increases or decreases in property values in various regional markets. Economists also believe that by providing information to investors on expectations of long-run price trends these futures may also signal when real estate is overpriced and thus deter the formation of bubbles. Noam Scheiber, *The Pork-Bellies Approach to Housing*, N.Y. TIMES MAG., Sep. 10, 2006, at 90.

147. Karl E. Case & Robert J. Shiller, *The Behavior of Home Buyers in Boom and Post-Boom Markets*, NEW ENG. ECON. REV., Nov.–Dec. 1988, at 29, 44–45.

148. Karl E. Case & Robert J. Shiller, *Is There a Bubble in the Housing Market?*, 2 BROOKINGS PAPERS ECON. ACTIVITY 299 (2003).

149. *See* SHILLER *supra* note 15, at 222–23.

150. *See infra* notes 296–97 and accompanying text.

raising interest rates in many cases could have the effect of pricking a bubble.[151]

The power of interest-rate increases to prick asset-price bubbles suggests that interest rates and the availability of credit might help explain the formation of bubbles, but this possible connection remains underexplored in the economic literature.[152] But for purposes solely of evaluating the effectiveness of antibubble laws, theory may not be essential, as macroeconomic evidence that interest rates can prick asset-price increases provides a shortcut.

III. THE EFFECTIVENESS OF ANTIBUBBLE LAWS

Economic theories of bubble formation are important not least because policymakers, legal scholars, and economists have used them to craft laws and policies to prevent asset-price bubbles, prick bubbles

151. *Compare* Ben S. Bernanke & Mark Gertler, *Should Central Banks Respond to Movements in Asset Prices*, AM. ECON. REV., May 2001, at 253 (arguing that monetary policy should not be used to prick asset-price bubbles), *with* Stephen G. Cecchetti et al., *Asset Prices in a Flexible Inflation Targeting Framework*, *in* ASSET-PRICE BUBBLES, *supra* note 18, at 427, 438–41 (arguing that monetary policy can and should respond to "asset price misalignments").

152. One controversial exception is the theory that asset-price bubbles might be spurred by investor anticipation of fluctuations in interest rates due to inconsistent and changing monetary policy (labeled "process switching"). Robert P. Flood & Robert J. Hodrick, *Asset Price Volatility, Bubbles and Process Switching*, *in* SPECULATIVE BUBBLES, SPECULATIVE ATTACKS, AND POLICY SWITCHING 135, 136 (Robert P. Flood & Peter M. Garber eds., 1994). In many macroeconomic models that examine the effects of interest rates on asset-price bubbles, asset-price bubbles are exogenous and their formation need not be explained. *See, e.g.*, Ben Bernanke & Mark Gertler, *Monetary Policy and Asset Price Volatility* 7, 15–25 (Nat'l Bureau of Econ. Research, Working Paper No. 7559, 2000).

Several theories may explain the link between interest rates and bubbles. First, lower interest rates may fuel speculation through provision of cheap credit to investors purchasing assets, and rising interest rates make borrowing these funds too expensive. *See* Stephen Malpezzi & Susan M. Wachter, *The Role of Speculation in Real Estate Cycles*, 13 J. REAL EST. LITERATURE 143 (2005).

But this theory is problematic, as lower costs of borrowing could stimulate investing in assets without necessarily causing prices to deviate from fundamental value. This necessitates consideration of alternative theories. A second theory is that lower interest rates may cause investors to suffer from "money illusion," or the mistaken belief that assets purchased with credit are cheaper in real terms. *See* Brunnermeier & Julliard, *supra* note 144, at 1–3; Eldar Shafir et al., *Money Illusion*, 112 Q. J. ECON. 341 (1997). The first and second theories can be synthesized into a third theory. Even if lower costs of borrowing stimulate asset prices without deviating from fundamental value, the price boom may encourage noise traders to chase a price trend, perhaps in the mistaken belief that the boom stems from a transformational change in fundamental value.

that have formed, or dampen the severity of asset mispricings during bubbles.

A. Proposed and Current Antibubble Laws

This Section outlines how policymakers and scholars have inferred policy conclusions from those economic theories outlined in Part II to craft antibubble laws. This Article creates a new typology for proposed and current antibubble laws with the following four categories: (1) laws that provide investors with higher-quality information about fundamental values of assets; (2) laws that attempt to short-circuit positive-feedback investment strategies; (3) laws that aim to enable arbitrage; and (4) laws that aim to restrict credit to investors to dampen "excessive" speculation.

1. IMPROVING INFORMATION TO INVESTORS AND INFORMATION PROCESSING OF INVESTORS

Some scholars have posited that the development of asset-price bubbles or excessive speculation can be hindered by providing investors with higher-quality information on fundamental values or improving their ability to process fundamental information.[153] Other behavioral finance scholars argue that with clearer information on fundamentals, investors will focus less on noise, such as price trends.[154] Scholars who follow rational-bubble models have also advocated enhanced securities disclosure to remedy information asymmetries that can cause bubbles. For example, Randall Krozner, then a member of the Council of Economic Advisors, framed the George W. Bush administration's 2002

153. Some scholars who have advocated disclosure as an antidote for bubbles subscribe to the theory that bubbles stem from the heterogeneous expectations of investors; disclosure could mitigate the incidence and severity of bubbles by encouraging investors to form common expectations of future asset prices. Gabaldon, *supra* note 9, at 283–84; Stout, *supra* note 18, at 695–97. By contrast, a few scholars have recommended tailoring securities-disclosure requirements to take into account behavioral and emotional responses to information by investors. *See, e.g.*, Huang, *supra* note 83, at 518–22.

154. Nicholas L. Georgakopoulos, *Why Should Disclosure Rules Subsidize Informed Traders*, 16 INT'L REV. L. & ECON. 417, 424 (1996) (arguing that disclosure may cause noise traders to reconsider beliefs). Some scholars take an alternative approach and argue that disclosure reduces the effect of noise traders by increasing the number and influence of "informational traders." *Id.*; Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 739 (2006). Other scholars have used the findings of behavioral finance to argue that mandatory disclosure promotes noise trading. *E.g.*, Paul G. Mahoney, *Is There a Cure for "Excessive" Trading?*, 81 VA. L. REV. 713, 743 (1995).

ten-point securities-disclosure initiative as a means of reducing the likelihood of asset mispricing and bubbles.[155]

Mirroring disclosure recommendations, scholars recommend investor-education programs—including government-sponsored or government-mandated programs—to mitigate the risk of speculative excess.[156] Some economists advocate creating new futures markets to provide clearer signals to investors when short-time price increases appear unsustainable.[157]

But, with the exception of creating futures markets, these proposals for enhanced securities-law-disclosure regulations and investor education are somewhat inchoate; it is unclear what these proposals would concretely add to existing federal securities-law-disclosure requirements. Formulating more concrete disclosure proposals (or investor-education programs) recalls the central problems in defining what constitutes fundamental value. Indeed, a great deal of information may shed light on an asset's future income potential, but what information would cut through noise and be most salient for investors remains an open question.

2. SHORT CIRCUITING POSITIVE-FEEDBACK INVESTMENT LOOPS

Even if a large group of investors persist in trading on noise, some economists and legal scholars advocate policies to break down the positive-feedback loops caused by these investors. These policies can take several forms. First, several scholars have argued that, if noise traders create a severe risk of widespread mispricing of assets, then the government should restrict their access to markets or channel their investments to less risky assets.[158] In a sense, these proposals turn the

155. Kroszner, *supra* note 18, at 8–12. In this same article, Kroszner also argues that Bush administration proposals to alter the Employee Retirement Income Security Act would serve these same goals by giving employers greater flexibility to sponsor investment advice for employees and clarifying the employer's legal liability in doing so. *Id.* at 8–10.

156. De Bondt, *supra* note 86, at 212; Gabaldon, *supra* note 9, at 280–83; *cf.* Lawrence A. Cunningham, *Behavioral Finance and Investor Governance*, 59 WASH. & LEE L. REV. 767, 788–96 (2002) (proposing investor-education programs to remedy investor behavioral biases).

157. ROBERT J. SHILLER, MACRO MARKETS: CREATING INSTITUTIONS FOR MANAGING SOCIETY'S LARGEST ECONOMIC RISKS 204–05 (1993).

158. Stephen Choi has argued for an investor-licensing regime that would classify investors according to their informational resources and provide more securities law protection to those investors with less information. Stephen Choi, *Regulating Investors Not Issuers: A Market-Based Proposal*, 88 CAL. L. REV. 279 (2000). Choi summarizes the scheme: "much like a pilot's license, investors would need an investment license to deal with particular types of capital market participants." *Id.* at

traditional logic of investor protection on its head: rather than protecting individual investors from the ravages of markets, these policies look to protect markets from the ravages of individual investors.

A second approach to counter positive-feedback investing is using tax policy to increase the costs to investors who rapidly flip assets. A number of prominent economists and legal scholars have advocated various forms of taxes—from increasing short-term–capital-gains tax rates to instituting a transaction tax—to curb excessive speculation and improve market efficiency.[159]

Circuit breakers and reverse circuit breakers represent a third alternative to combating asset-price bubbles and excessive speculation. Although not the only justification for circuit breakers, one theory behind these mechanisms is to provide investors with a cooling-off period to reconsider participating in the herd behavior that may drive meteoric price rises or crashes.[160]

As with the first category of antibubble policies, many of the ideas to break feedback loops can be found in existing law and regulation. The first approach, restricting the access of unsophisticated investors to certain markets or channeling these investors into less risky investments, is implicit in the way in which securities-law exemptions create tiers of investors. Certain exemptions from the registration requirements of federal securities law allow institutional investors,[161] investors with high net worth,[162] or investors that meet certain sophistication standards[163] to invest in securities that are accompanied by less disclosure. Furthermore, the Investment Company Act contains

283. Choi compares his proposal to the existing securities-law regime of exemptions to issuer registration that attempts to tailor information requirements according to the sophistication of investors. *Id.* at 305–07; *see also* Gabaldon, *supra* note 9, at 279, 282–83 (considering restricting access of investors to markets or investor licensing schemes to combat investor speculation).

159. *See supra* note 11.

160. *See* Gabaldon, *supra* note 9, at 283 (advocating reverse circuit breakers for this reason); SHILLER, *supra* note 15, at 225–26 (describing this rationale but questioning the effectiveness of circuit breakers).

161. Rule 144A of the Securities Act of 1933 allows private resale of securities to "qualified institutional buyers." 17 C.F.R. § 230.144A (2007).

162. Rules 505 and 506 of Regulation D of the Securities Act of 1933 do not require disclosure to "accredited investors" and do not count these investors toward the limit on the number of purchasers in their respective exemptions. *Id.* §§ 230.505–.506. Regulation D defines "accredited investors" as certain institutions and individuals whose net worth exceeds certain thresholds. *Id.* § 230.501(a).

163. Under an exemption in Rule 506, issuers may still sell securities to investors that are not accredited, *see supra* note 162, provided that these nonaccredited investors meet certain sophistication standards. 17 C.F.R. § 230.506(b)(2)(ii).

exemptions for issuers whose stock is owned by certain institutions or high-net-worth individuals.[164] These exemptions allow many hedge funds to act outside the purview of that statute.[165] Commodities laws and regulations contain similar exemptions for institutions and high-net-worth individuals.[166] This tiering of investors could be thought of not only as tailoring the disclosure requirements and protections of the federal securities laws to the protection needs of certain classes of investors[167] but also as effectively channeling lower-net-worth and less sophisticated individual investors toward less risky investments.[168]

Using tax policy to curb speculation—the second approach to cutting positive-feedback investment loops—is an element of existing tax and securities rules in the United States. The difference between short-term and long-term capital gains taxes[169] and securities rules that

164. 15 U.S.C. § 80a-3(c)(7) (2000).

165. William W. Bratton, *Hedge Funds and Governance Targets*, 95 GEO. L.J. 1375, 1382 n.33 (2007).

166. Arthur E. Wilmarth, Jr., *The Transformation of the U.S. Financial Services Industry, 1975–2000: Competition, Consolidation, and Increased Risks*, 2002 U. ILL. L. REV. 215, 333 n.488.

167. This logic of tailoring disclosure to meet the needs of investors for protection was adopted by the Supreme Court in SEC v. Ralston Purina Co., 346 U.S. 119, 124–25 (1953) (determining whether a securities offering was a "public offering," and thus not entitled to the private-offering exemption from registration requirements, by looking to the sophistication of the investors).

168. Interpreting exemptions with an eye towards matching investors with risk accords with the way many in the federal-securities bar interpret *Ralston Purina*. *See supra* note 167; Federal Regulation of Securities Committee, Am. Bar Ass'n, *Section 4(2) and Statutory Law*, 31 BUS. LAW. 485, 491–95 (1975) (arguing that one factor in interpreting *Ralston Purina* and applying the private-placement exemption from federal securities laws should be the purchaser's risk-bearing ability). However, the mere fact that securities are registered with the SEC and are sold with increased disclosure does not guarantee that they are less risky than securities sold pursuant to an exemption. This tiering effect is reinforced by other securities laws that require securities intermediaries to take into account the specific circumstances of individual clients in providing advice and facilitating investments. The suitability requirements imposed on broker-dealers by the National Association of Securities Dealers represents the most prominent example of this type of rule. *See* Daniel G. Schmedlen, Jr., *Broker-Dealer Sales Practice in Derivatives Transactions: A Survey and Evaluation of Suitability Requirements*, 52 WASH. & LEE L. REV. 1441, 1456 (1995) (analyzing National Association of Securities Dealers suitability requirements in the context of derivative sales); National Association of Securities Dealers, Rules of the Association, Rule 2310 (2007), *available at* http://finra.complinet.com/finra/index.html ("Recommendations to Customers (Suitability)").

169. C. Thomas Paschall, *U.S. Capital Gains Taxes: Arbitrary Holding Periods, Debatable Tax Rates*, 73 S. CAL. L. REV. 843, 861–64 (2000) (arguing that legislators in the United States and Europe intended that holding periods for capital-gains taxes would discourage speculation).

require certain inside investors to disgorge short-swing profits[170] already combine to impose costs on flipping and discourage speculation. Other countries have also experimented with more direct transaction taxes to cool speculation and correct mispricings from potential bubbles. Most recently, in May 2007, China imposed higher taxes on stock trades to curb what many saw as a rising stock-market bubble.[171]

Circuit breakers, the third approach noted above, have been in place in several U.S. financial exchanges, including for almost two decades in the New York Stock Exchange.[172]

3. REMOVING BARRIERS TO ARBITRAGE

Rather than create policy incentives to break the feedback loops of noise traders, the final antibubble approach in the behavioral finance template is to allow the market to correct mispricings by removing barriers to arbitrage. In particular, a number of prominent scholars, with different views on the rationality of markets, have argued that restrictions on short sales, such as the tick test, should be removed to promote market efficiency.[173] As noted above, in June 2007, the SEC repealed the tick test in part to promote the efficient pricing of stock markets.[174]

4. TIGHTENING CREDIT

Other antibubble policies build not on microeconomic research on noise traders but on macroeconomic research into the role that credit policy can have in pricking asset-price bubbles. Macroeconomists remain locked in debate regarding the wisdom of using monetary policy to address asset-price inflation or to prevent or prick asset-price

170. Comment, *Short-Swing Profits and the Ten Percent Rule*, 9 STAN. L. REV. 582, 586 (1957) (noting that Congress intended section 16(b) of the Securities Exchange Act to discourage insider speculation).

171. Barboza & Bradsher, *supra* note 2.

172. *See supra* note 16 and accompanying text.

173. *E.g.*, Powers et al., *supra* note 13, at 264–70 (arguing for removal of the uptick rule and other legal restrictions on short sales); Lynn A. Stout, *Why the Law Hates Speculators: Regulation and Private Ordering in the Market for OTC Derivatives*, 48 DUKE L.J. 701, 761–62 (1999) (noting that easing restrictions on short sales may be a remedy for bubbles but may also increase market volatility).

174. *See supra* note 15 and accompanying text. At the same time, however, the SEC did place additional restrictions on "naked" short selling, that is, when the investor does not own and has not borrowed the securities it is selling short.

bubbles.[175] As monetary policy is less a subject for legal scholarship, other scholars have focused on laws that restrict lending to investors, such as federal margin regulations.[176] The statute granting the SEC authority to enforce margin regulations states that one of the principal purposes of these regulations is to curb excessive speculation.[177] Professor Roberta Karmel criticized the Federal Reserve and the SEC for failing to use existing margin regulations to tighten credit to investors and thus prevent the technology-stock bubble of the late 1990s.[178]

B. Using Experimental Asset Markets To Evaluate Effectiveness

Evaluating the effectiveness of the laws described above with empirical evidence alone is difficult given (1) the problems with identifying historical asset-price bubbles, outlined above,[179] and (2) the challenges of untangling causal links given that antibubble laws represent only one of myriad economic factors affecting asset prices in real markets.[180] Experimental asset markets offer novel solutions to both of these problems. First, economists can create simulated markets where the securities being traded have definite fundamental value.[181] Any experiment in which prices diverge significantly from fundamental value indicates that an asset-price bubble has formed.[182] Experimental

175. For a detailed account of this controversy, with emphasis on the approach of the Central Bank of Japan during the real-estate bubble in that country during the late 1980's, see Geoffrey P. Miller, *The Role of a Central Bank in a Bubble Economy*, 18 CARDOZO L. REV. 1053 (1996). *See also* Kevin J. Lansing, *Should the Fed React to the Stock Market*, FRBSF ECON. LETTER (Fed. Res. Bank of S.F. , Nov. 14, 2003).

176. *E.g.*, Karmel, *supra* note 9, at 948. The Federal Reserve sets margin requirements, *see, e.g.*, 12 C.F.R. § 220 (2007), which the SEC has authority to enforce, 15 U.S.C. § 78(g) (2000).

177. 15 U.S.C. § 78b(3); JERRY W. MARKHAM & THOMAS LEE HAZEN, BROKER-DEALER OPERATIONS UNDER SECURITIES AND COMMODITIES LAW §§ 3.01–.02 (2001). Professors Markham and Hazen note that the Federal Reserve has reset margin rates twenty-five times in history "to squelch speculation in the case of increases or to ease access to the market during downturns" and that "most actively traded stock is today subject to a margin requirement of fifty percent." MARKHAM & HAZEN, *supra*, § 3.01–.02.

178. *See* Karmel, *supra* note 9, at 948. Paralleling the margin regulations, federal commodities law authorizes regulators to impose position limits on investors in commodity exchanges, and the authorizing statute likewise recites the objective of curbing harmful speculation. 7 U.S.C. § 6a.

179. *See supra* Part II.A.

180. Proving the negative, for example, that an asset bubble has been prevented, presents particular challenges.

181. Porter & Smith, *supra* note 23, at 111.

182. Smith et al., *supra* note 131, at 1125–28.

asset markets, unlike empirical studies, allow experimenters to create risk not uncertainty for their subjects.

Second, economists can mimic antibubble laws in these markets by controlling for both environmental conditions and trading rules. The careful design of these controls allows experimental economists to isolate causal links with greater precision than many empirical tests.[183]

1. VALIDITY OF EXPERIMENTAL ECONOMICS IN GENERAL

Generating conclusions from the laboratory that would apply to the real world requires that the experiments have a requisite degree of realism or "validity." Experimental economists have identified three assumptions that must hold true for experiments to generate implications for real-world markets.[184] First, experiment subjects must prefer receiving more money to less.[185] This assumption guarantees that experiments have internal validity. Monetary payoffs made to subjects according to their performance in the experiment must induce preferences in the subjects.[186] Over the last two decades, experimental economists have provided extensive support for this assumption; studies have shown that even small payoffs cause experimental subjects to behave in predictable ways.[187] Experimental economists have responded to a persistent critique that the small stakes involved undermine the internal validity of experiments,[188] with extensive support that even small payoffs cause participants to take their performance in the experiments seriously.[189] Economists further argue that monetary payoffs in experimental asset markets, such as those discussed below,

183. Smith, *supra* note 33, at 923–35.

184. Hoffman & Spitzer, *supra* note 30, at 991.

185. *Id.*

186. Vernon L. Smith, *Experimental Economics: Induced Value Theory*, AM. ECON. REV., MAY 1976, at 274, 274–77.

187. *See, e.g.*, Colin F. Camerer & Robin M. Hogarth, *The Effects of Financial Incentives in Experiments: A Review and Capital-Labor-Production Framework*, 19 J. RISK & UNCERTAINTY 7 (1999) (analyzing seventy-four experimental studies to determine whether incentive levels or monetary versus nonmonetary payoffs improved subject performance).

188. Even early reactions among legal scholars reflected this concern. *See, e.g.*, Stewart E. Sterk, *Neighbors in American Land Law*, 87 COLUM. L. REV. 55, 73 n.69 (1987) (critiquing whether experiments used to support Coase Theorem are valid given the small stakes involved).

189. *E.g.*, Camerer & Hogarth, *supra* note 187.

improve validity over experiments with nonmonetary payoffs,[190] such as experiments in which coffee mugs are traded.[191]

This concern over the realism of incentives in experiments points to the second assumption underlying experimental economics—that the basic rules governing individual behavior in the real economy also govern subjects in the experiment.[192] Experimental economics rests on a final assumption—sometimes labeled "parallelism"—that all relevant features of actual markets have been incorporated into simulated markets.[193]

2. BASIC DESIGN OF EXPERIMENTAL ASSET MARKETS

In evaluating whether the experimental asset markets that test for bubbles meet the second and third criteria, it is crucial to carefully evaluate their design.[194] When constructing these markets, Professor Vernon Smith established an experiment protocol to allow other researchers to replicate the research.[195] According to the protocol, and in addition to the experiment parameters described above,[196] a fixed number of traders bought and sold a uniform security in a double-continuous auction conducted through a computer network. Traders were given an initial endowment of shares and cash and, at the end of the experiment, received the sum of any cash remaining, all dividends paid on shares when held, and any capital gains from trading less any

190. Ralph Hertwig & Andreas Ortmann, *Experimental Practices in Economics: A Methodological Challenge for Psychologists?*, 24 BEHAVIORAL & BRAIN SCIS. 383, 401 (2001).

191. As one example, proponents of behavioral law and economics have referenced various experiments in which subjects traded coffee mugs as evidence of the "endowment effect" (the propensity for individuals to place a higher value on objects they already own than on objects they do not). *See, e.g.*, Jolls et al., *supra* note 86, at 1483 (citing Daniel Kahneman, et al., *Experimental Tests of the Endowment Effect and the Coase Theorem*, 98 J. POL. ECON. 1325, 1329–42 (1990)). This reliance of behavioral economics on fairly basic experiments, many with nonmonetary payoffs, may explain persistent criticism of behavioral law and economics. *See, e.g.*, Richard A. Posner, *Rational Choice, Behavioral Economics, and the Law*, 50 STAN. L. REV. 1551, 1565–67 (1998) (critiquing conclusions drawn by the authors above from coffee-mug experiments).

192. Hoffman & Spitzer, *supra* note 30, at 992–93.

193. *Id.*

194. *Id.* at 993.

195. For the basic formulation of this protocol, see Smith et al., *supra* note 131, at 1122–25. This Section describes the general parameters of the experiments conducted by Smith and colleagues. When other experimental asset markets that had different parameters are considered in Part III.C, differences from this general design are noted.

196. *See supra* notes 134–35 and accompanying text.

capital losses. In any trading period, a trader could either buy or sell by pressing a simple series of keys on their computer terminal. A trader could buy the security if he or she had sufficient cash holdings to pay the purchase price and sell as long as he or she had the shares to complete the sale.[197]

Experiments lasted for a preannounced number of trading periods.[198] Each trading period ended either with unanimous consent of all participants or at the end of a preannounced period of time.[199] The markets combined a bid-ask–spread-reduction rule with a rank-queue limit-order file, that is, bids to buy below the highest standing bid and offers to sell above the lowest standing offer were not rejected but queued in a limit-order file. Once a bid and offer were matched and a contract occurred, the highest queued bid and the lowest queued offer became the new bid-ask spread. Traders were aware of the position of their bids and offers in the limit-order file and could withdraw them at any time.[200]

This basic protocol has been followed in numerous experiments over the last two decades. In each experiment, economists were able to compare period by period the prices set by the traders with the fundamental, or "intrinsic price," of the security being traded (with fundamental value equaling the expected dividend value multiplied by the number of trading periods remaining in the experiment). As previously noted, in a wide range of experiments, trade prices shot above intrinsic value, crashing back down to that value only in the final trading period.[201]

3. EXPERIMENTAL CONTROLS AND THEIR EFFECTS ON BUBBLES

These bubble results prompted early reviewers to note how these experimental markets may not have reflected material attributes of real markets that would have prevented such mispricings.[202] In response to these critiques, Smith and other researchers introduced new variables in the experiments to test whether alternative conditions found in real-

197. Smith et al., *supra* note 131, at 1122–25.

198. In most of Smith's experiments there were fifteen trading periods. *See, e.g.*, King et al., *supra* note 24, at 183.

199. Generally, the trading period lasted a maximum of four minutes. Smith et al., *supra* note 131, at 1124.

200. King et al., *supra* note 24, at 184; Smith et al., *supra* note 131, at 1122–25.

201. *See supra* note 132 and accompanying text.

202. *See* Caginalp et al., *supra* note 131, at 26–32 (describing changes to the experimental environment to make experiments match attributes of real markets).

world securities markets might prevent, prick, or dampen bubbles. These new control variables included:

- Informing traders of the results of previous experiments[203]
- Repeating experiments to give traders experience[204]
- Allowing traders to enter into futures contracts[205]
- Varying the financial sophistication of traders[206]
- Changing the relative initial endowments of cash and shares held by traders[207]
- Charging a fee for trades[208]
- Implementing capital-gains taxes[209]
- Instituting circuit breakers[210]
- Restricting the resale of purchased securities[211]
- Allowing traders to make short sales[212]
- Allowing traders to buy securities on margin[213]

The introduction of these controls gave experimental asset markets many features of real securities markets and replicated many antibubble laws. As described in Part III.C, bubbles in asset markets proved robust to the introduction of most of these controls.

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203. Traders were given copies of previous studies of experimental asset markets that showed prices exceeded fundamental value. *E.g.*, King et al., *supra* note 24, at 190–94.

204. Multiple experiments were rerun with at least some traders having participated in earlier experiment iterations. *See, e.g.*, King et al., *supra* note 24, at 186–200; Smith et al., *supra* note 131, at 1133–36.

205. Porter & Smith, *supra* note 23, at 120.

206. Criticisms of the validity of early experiments that used undergraduate economics students as traders were addressed by later experiments that used small-business people, corporate executives, and stock-market dealers as subjects. Caginalp et al., *supra* note 131, at 28.

207. *Compare* Smith et al., *supra* note 131, at 1124 (using unequal endowments of cash and assets), *with* King et al., *supra* note 24, at 189 ("buyers [tend] to be those subjects with endowments large in cash and small in shares; the reverse holds for sellers.").

208. King et al., *supra* note 24, at 190.

209. Vivian Lei et al., *Asset Bubbles and Rationality: Additional Evidence from Capital Gains Tax Experiments* 1–2 (Cal. Inst. of Tech., Working Paper No. 1137, June 2002), *available at* http://www.hss.caltech.edu/SSPapers/wp1137.pdf.

210. King et al., *supra* note 24, at 194–95.

211. Lei et al., *supra* note 137, at 834.

212. King et al., *supra* note 24, at 186–88.

213. *Id.* at 188–89.

4. EXTERNAL VALIDITY AND LIMITATIONS OF BASIC DESIGN

It is crucial, however, to highlight some of the limitations of these experiments before attempting to draw legal and policy conclusions from them. This Section highlights certain limitations to the general design of the experimental asset markets described above. Limitations on results from specific experiments that mimic antibubble laws are described in Part III.C.

By necessity, experiments need to simplify the complex mechanisms present in real-world markets, but five general limitations regarding experiments conducted under the Smith protocol stand out. First, traders were given the rewards of their performance,[214] but they did not have to pay losses from their own pockets.[215] This may have skewed experimental results somewhat as behavioral economists have documented asymmetries in the appetites of individuals for bearing risk that would lead participants to make gains-versus-risk assessments that would cause greater-than-expected losses. For example, gamblers playing with house money tend to make riskier bets.[216] Nevertheless, a different set of experiments in which subjects traded their own money also produced bubbles.[217] The similarities in the results of these studies (despite their different design features) suggest that the Smith protocol's failure to impose losses on subjects is not fatal to its validity.[218]

Second, real securities markets do not end after a predetermined number of trading periods. This leads to a possible objection that

214. Caginalp et al., *supra* note 131, at 26.

215. Camerer & Hogarth, *supra* note 187, at 36 ("Because it is generally difficult to impose losses or punishments on subjects for bureaucratic reasons—university committees that approve protocols involving human subjects strongly object to it—we do not know how earning money and losing money differ.").

216. Behavioral-economics literature often recites the "loss-aversion" bias (i.e., that individuals are willing to take on less risk that would lead to losses than risk that would lead to the same amount of gains). *See, e.g.*, Daniel Kahneman et al., *Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias*, J. ECON. PERSP., Winter 1991, at 193; Robert A. Prentice & Jonathan J. Koehler, *A Normality Bias in Legal Decision Making*, 88 CORNELL L. REV. 583, 601–02 (2003).

217. James S. Ang & Thomas Schwarz, *Risk Aversion and Information Structure: An Experimental Study of Price Variability in the Securities Markets*, 40 J. FIN. 825, 830–31 (1985).

218. Nevertheless, the Ang and Schwarz experiments in which traders invested with their own money did not feature the full set of controls—including all of the controls that mimic the various antibubble laws—that the experiments following the Smith protocol did. *See supra* note 216. The potential for skewed results in the Smith protocol experiments—because subjects were "playing with house money"—argues for rerunning the Ang and Schwarz experiments with controls that mimic more antibubble laws.

crashes would chasten traders.[219] Experimenters considered this, and many studies repeated the experiments several times with the same traders.[220] Indeed, experience did significantly dampen the propensity of traders to bid prices above fundamental value.[221] Thus, experience dampens bubbles in the experiments, but "experience" means participating in experimental asset markets and experiencing a bubble and crash, not real-world financial experience. Experiments featuring individuals with real-world financial experience as traders—small-business owners, stock brokers, and executives—produced bubbles.[222]

Third, it is also possible that, in each experiment, a looming final horizon made traders try to achieve unrealistically high short-term gains. This objection is harder to address, as the finite number of trading periods was a necessary component of establishing certain fundamental value for the securities.[223]

The elegance of the experimental controls creates a fourth potential limitation. Although some experiments tried introducing various policies and environmental features in combination, the experiments may have missed potential combinations of controls that might together have reduced the incidence or severity of mispricings. It is possible that the aggregate effect of multiple antibubble laws on reducing mispricings may be greater than a sum of their individual effects. Without resorting to a "kitchen sink" approach, future experiments might productively test additional combinations of controls, such as allowing short sales and futures contracting, simultaneously.

219. Smith et al., *supra* note 131, at 1133 (noting this potential flaw).

220. *See supra* note 204.

221. Caginalp et al., *supra* note 131, at 26.

222. King et al., *supra* note 24, at 196–97.

223. Other experiment-based asset-market research supports the hypothesis that short horizons promote bubble formation. *See* Shinichi Hirota & Shyam Sunder, *Price Bubbles Sans Dividend Anchors: Evidence from Laboratory Stock Markets*, 31 J. ECON. DYNAMICS & CONTROL 1875 (2007).

Some scholars have raised a related criticism, namely that Smith's design predetermined a crash by setting fundamental values to decline to zero. These scholars found that when fundamental value was held constant prices of securities traded close to fundamental value. Dean Johnson & Patrick Joyce, Bubbles and Crashes Revisited (Oct. 2006) (unpublished manuscript, *available at* http://www.gate.cnrs.fr/seminaires/2006_2007/Joyce.pdf). But this research does not appear to have been replicated. Other studies of experimental asset markets with a flat fundamental value showed recurring bubbles. *E.g.*, Charles Noussair et al., *Price Bubbles in Laboratory Asset Markets with Constant Fundamental Values*, 4 EXPERIMENTAL ECON. 87 (2001); AJ Bostian et al., Price Bubbles in Asset Market Experiments with a Flat Fundamental Value (Aug. 30, 2005) (unpublished manuscript, *available at* http://www.atl-res.com/finance/conference_pdf/HoltFinal.pdf).

The fifth limitation of the experiments is their applicability to real-estate markets. The economic characteristics described in Part II.D that differentiate real estate from securities assets—durability, heterogeneity, possession of consumption value—also limit the parallelism of liquid experimental asset markets to actual real-estate markets.[224] Therefore, an evaluation of the effectiveness of antibubble laws with respect to real-estate markets must give much greater weight to empirical evidence than to these experimental studies.

Legal scholars might raise a final concern about the use of experimental asset markets to justify laws or regulations, namely that motivated individuals will find loopholes in real-world laws. But this objection is asymmetric; it does not support the reverse contention that the many antibubble policies that appeared ineffective in experiments may have greater effect in actual markets.

C. Evaluating the Evidence

Bearing in mind these limitations of experimental asset markets, experimental evidence can be used, together with empirical evidence, to evaluate the effectiveness of the antibubble laws outlined in Part III.A.

1. IMPROVING FUNDAMENTAL INFORMATION TO INVESTORS AND INFORMATION PROCESSING OF INVESTORS

Evidence from experimental asset markets draws into question the effect that enhanced disclosure requirements and mandated investor-education programs would have in preventing, pricking, or mitigating the severity of asset-price bubbles.

a. Disclosure

Bubbles formed in experimental asset markets even when investors were given all the information necessary to compute fundamental value.[225] Calculating expected future dividends required investors to perform simple multiplication.[226] The experimenters could have

224. For example, traders in these virtual markets could not have enjoyed any consumption value from the securities being traded, but real-estate investors often do place such a value on their properties. *Supra* note 141.

225. Porter and Smith phrase the conclusion: "Public information in intrinsic dividend (or net asset) value is not sufficient to induce common expectations and trading at fundamental value." Porter & Smith, *supra* note 23, at 114.

226. Fundamental value equaled (1) the probability of a dividend multiplied by (2) the amount of a possible dividend multiplied by (3) the number of trading periods remaining in the experiment. *See* King et al., *supra* note 24, at 183.

performed the math for the investors, but in real-world markets, disclosure is unlikely to ever provide as clear an indication of an asset's fundamental value as the information given to subjects in these experiments.[227] The fact that bubbles formed when dividend uncertainty was removed (or, more accurately, converted into risk) suggests that even very high-quality disclosure to investors with respect to fundamental value will not eliminate bubbles.

This experimental evidence should not lead to the conclusion that mandatory-disclosure regimes have no prophylactic effect on mispricings. The fact that supplying investors with near-perfect information on fundamentals does not eliminate bubbles does not lead to a conclusion that disclosing imperfect information relevant to fundamentals would have no effect on reducing the incidence or magnitude of bubbles. Bubbles may have been more severe had the information on fundamental value been more opaque, imperfect, noisy, or even absent.

However, it is important to underscore again that these experimental asset markets allowed researchers to create known fundamental value and thus test investors under conditions of risk but not uncertainty. In real markets, investors face uncertainty about true fundamental value. It is possible, although not convincing, that under conditions of uncertainty, investors would be more responsive to disclosure—or other antibubble laws for that matter—than under conditions of risk. One theory is that investors were less risk averse and exhibited more overconfidence in experiments because they knew that they could theoretically recognize a guaranteed profit opportunity, since success could be calculated on the basis of definite probabilities.[228]

These limitations on using experimental results to judge the effects of disclosure laws on bubbles argue for a greater consideration of empirical studies. Empirical data comparing the incidence of bubbles in countries with varying levels of securities disclosure requirements has indicated that countries with weaker requirements tend to suffer more asset-price bubbles, and their asset-price bubbles tend to last longer and have a greater magnitude of mispricing.[229] In Asia, in particular,

227. *Supra* notes 134–35 and accompanying text.

228. Because the value of experimental asset markets lies in large part on having known fundamental values and thus being able to identify bubbles with certainty, it would be logically problematic to test whether experiment subjects operating in an environment of true uncertainty would be more or less likely to create bubbles. Again, using risk as a proxy for uncertainty may be unavoidable in this area of economics, but it also limits the validity of research.

229. William R. White, *What Have We Learned from Recent Financial Crises and Policy Responses?*, *in* GLOBAL FINANCIAL CRISES: LESSONS FROM RECENT EVENTS 177 (Joseph R. Bisignano et al. eds., 2000). These findings mesh with broader studies that have found a connection between investor-protection laws and the depth of a nation's securities markets. SHLEIFER, *supra* note 35, at 191–92 (surveying studies

economists have noted an inverse correlation between the incidence of asset-price bubbles and the strength and enforcement of a country's securities and financial disclosure requirements.[230]

Reconciling this experimental and empirical evidence leads to a conclusion that, although there is evidence that disclosure requirements may decrease the incidence and magnitude of bubbles, enhancing disclosure may have a decreasing marginal effect. Moreover, it would be a mistake to conclude that more disclosure is inevitably better. Investors can face "information overload" and may be unable to cognitively process more information.[231] In the case of more complex financial products, information asymmetries may be impossible to overcome with disclosure and education.[232]

Unfortunately, the empirical research outlined above was not designed to produce the optimally effective level or type of disclosure, and the antibubble disclosure proposals noted above provide little specificity as to what enhanced disclosure requirements might look like. Any additional disclosure will have to contend with two further limitations. First, the information marketplace becomes particularly crowded during booms; even cogent evidence that asset prices exceed fundamental values will face counterarguments, including "New Era" logic contending that fundamental changes in the economy have rendered conventional means of asset valuation obsolete.[233] This cacophony of opinions may explain the repeated failure throughout history of attempts by central bankers and other governmental officials to talk down or "jawbone" suspected asset-price bubbles.[234]

Second, investors often choose to ignore additional disclosure in boom times; throughout much of the last decade, bidders who hoped to

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showing a correlation between nations' investor-protection regimes and success in developing well-functioning and deep securities markets).

230. *See, e.g.*, STEPHAN HAGGARD, THE POLITICAL ECONOMY OF THE ASIAN FINANCIAL CRISIS 19 (2000); Robert Chote, *Financial Crises: The Lessons of Asia*, *in* FINANCIAL CRISES AND ASIA 1, 10 (1998).

231. Troy A. Paredes, *Blinded by the Light: Information Overload and its Consequences for Securities Regulation*, 81 WASH. U. L.Q. 417, 441 (2003).

232. Jeffrey Carmichael & Neil Esho, *Asset-Price Bubbles and Prudential Regulation*, *in* ASSET-PRICE BUBBLES, *supra* note 18, at 481, 491.

233. *See* SHILLER, *supra* note 15, at 96–132 (describing how popular perceptions during stock market expansions that "the future is brighter or less uncertain than it was in the past" can lead to asset-price bubbles).

234. The warning by Federal Reserve Chairman Greenspan in 1996 that the stock market was "irrationally exuberant" represents a recent example of such a failed attempt. KINDLEBERGER, *supra* note 37, at 7. For historical surveys of the futility of official warnings that a bubble may be occurring (in part, because of contrary statements by other officials), see *id.* at 91–94; CHANCELLOR, *supra* note 56, at 151, 230–31.

buy a house in "hot" real-estate markets, such as Washington, D.C., decided that they needed to waive inspection and appraisal rights in their offers.[235]

b. Information from futures markets

Futures markets appear to provide information to investors that is much more effective in reducing the magnitude of asset-price bubbles. Based on experimental asset markets in which certain experienced traders could enter into futures contracts and other traders could see the prices of these contracts,[236] experimenters concluded that "futures markets dampen, but do not eliminate, bubbles by speeding up the process by which traders form common expectations."[237] Traders who can better calculate fundamental values can set futures prices and send a clear signal to others in the market of long-term expectations for these values.

Experimental evidence would support economist arguments that developing futures markets for real estate and other asset classes will not only allow investors to mitigate risk but also provide them with clearer information on potential mispricings.[238] But real-world futures are complex financial instruments, and it is questionable whether many "noise traders" would be able to understand the price signals they send.

c. Investor education

One response to the inability of investors to understand futures would be enhanced investor-education programs, but, like disclosure, the evidence of the effectiveness of investor education is mixed. Even in experimental asset markets with more–financially sophisticated

235. Daniela Deane, *Higher Prices, Tougher Choices*, WASH. POST, Mar. 23, 2005, at H1.

236. Porter & Smith, *supra* note 23, at 120. Experimenters first conducted a series of two-period training sequences in which traders could enter into futures contracts in period one and the contracts would mature in period two. This taught traders "that a futures contract is equivalent to a cash contract in the period in which it expires, and should trade at the same price." Caginalp et al., *supra* note 131, at 30. In the actual experimental markets with fifteen trading periods, traders could enter into spot and futures contracts for the first eight periods, with futures contracts expiring in period eight. After the eighth period, traders could only enter into spot contracts. Caginalp et al., *supra* note 131, at 30.

237. Porter & Smith, *supra* note 23, at 120; *see also* Charles Noussair & Steven Tucker, *Futures Markets and Bubble Formation in Experimental Asset Markets*, 11 PAC. ECON. REV. 167 (2006).

238. *Supra* notes 147 and 157 and accompanying text. This finding meshes with the heterogeneous-expecations model of bubbles.

traders—small-business persons,[239] securities brokers,[240] and corporate executives[241]—bubbles formed. On the other hand, in experiments with subjects who were advanced graduate students in economics and familiar with game theory, prices closely tracked fundamental value.[242]

Experimenters even attempted one form of investor education by giving another set of graduate-student subjects copies of earlier studies that analyzed how bubbles formed in similar experimental asset markets. Merely providing this information did not prevent a bubble from occurring; only a combination of having subjects read these studies *and* repeat the experiment *and* be allowed to engage in short selling led to prices tracking fundamental value, albeit roughly.[243]

But any inference that investor-education policies might work to counter bubbles based on the success of graduate students literate in game theory must be severely tempered. Economics graduate students familiar with experimental literature are likely to intuit the researchers' objectives. Subjects focusing on the experimental conceit would undermine the second fundamental assumption of experimental economics—that human behavior in the experiments mirrors behavior in real markets.[244]

d. Experiencing a bubble and a crash

The ultimate form of investor education, and the one most effective in preventing bubbles, appears to be the experience of participating in the rise and crash of a bubble. One of the strongest findings in experimental economics has been the effects of experience. After investors experience and participate in an asset-price bubble and a subsequent crash in one experiment, they are much less likely to bid prices higher than fundamental value in subsequent iterations of the experiment.[245] In fact, when other experiments that control for other policies and market features are repeated, it appears that it is

239. Smith et al., *supra* note 131, at 1130–31.

240. King et al., *supra* note 24, at 196–97.

241. *Id.*

242. Caginalp et al., *supra* note 131, at 28–29. Undergraduate economics students produced dramatic bubbles in trading. *Id.*

243. King et al., *supra* note 24, at 190–93. But, if the percentage of traders who lacked experience in the experimental asset markets and were not informed of the studies is too high, bubbles formed as "experienced" and "informed" traders did not have sufficient resources to undercut bubble prices through short selling. *Id.* at 193–94.

244. *Supra* note 192 and accompanying text.

245. Caginalp et al., *supra* note 131, at 26; Smith et al., *supra* note 131, at 1133–36.

experience, not these other factors, that reduces the duration and amplitude of mispricing and the volatility and turnover of trading.[246]

Experimental evidence of the chastening effects that experiencing a bubble crash has on investor speculation accords with the findings of economic historians that asset-price bubbles tend to form in a particular market only after a significant period of time—sometimes a decade or more after the last significant crash.[247]

But this pattern may be an oversimplification. The collapse of one bubble may not inoculate investors or an economy from the rise of any asset bubbles for the foreseeable future; some economists have speculated that the crash of a bubble in one asset market can drive liquidity to another asset market and ignite speculation there (particularly if a central bank keeps interest rates low after the collapse of the first bubble). In fact, some economists tie the recent credit boom, which fueled corporate takeovers and real-estate speculation and then crashed in July 2007, to the Federal Reserve keeping interest rates low in the wake of the bursting of the technology-stock bubble in 2000.[248] Economists have posited that international links between economies allow investors looking to invest returns earned from an asset bubble in one country to fuel speculation in other countries. [249]

In short, a bubble in one asset class in one country may not chasten investors from creating a bubble in another type of asset or another market. Moreover, influxes of new generations of investors who have not experienced a bubble crash raise the risk of fresh market mispricings.[250]

246. *See* King et al., *supra* note 24, at 188–200.

247. KINDLEBERGER, *supra* note 37, at 13 ("[S]ome time must elapse after one speculative mania that ends in crisis before investors have recovered sufficiently from their losses and disillusionment to be willing to take a flyer again."); *see also* SHILLER, *supra* note 15, at 96–117 (surveying episodes of "new era economic thinking" in the United States in the twentieth century, which occurs "in pulses.")

248. For an accessible account of this theory, see Greg Ip & Jon E. Hilsenrath, *Debt Bomb*, WALL ST. J., Aug. 7, 2007, at A1.

249. Some economists believe that currency crises in China are having this effect on markets in other countries. *Id.* Economists have also studied the reverse problem of crashes in one market having cross-border effects through stock-market and other economic interlinkages. *See, e.g.*, Michael D. Bordo & Antu Panini Murshid, *Globalization and Changing Patterns in Crisis Transmission*, *in* ASSET-PRICE BUBBLES, *supra* note 18, at 309, 309–22.

250. Economists have created "overlapping-generations" models to study the potential effects of new investors entering markets. *See, e.g.*, Jean Tirole, *Asset-Price Bubbles and Overlapping Generations*, 53 ECONOMETRICA 1071 (1985) (concluding that new generations of investors overlapping with older generations allow bubbles to form). If new generations enter asset markets more quickly, the chastening effect of asset-bubble crashes may have a shorter duration.

Notwithstanding the fact that bubbles may recur sooner and with greater frequency in the real world than in experimental asset markets, experimental evidence of the powerful chastening effects of experiencing a bubble crash raises profound questions for policymakers and scholars. Assuming certain policies are effective in reducing the incidence or magnitude of bubbles, implementing these policies might deprive investors of the chastening education of losing money. This raises the question of whether even effective antibubble laws might merely lead to less frequent but more severe bubbles. More concretely, policies that may not prevent bubbles but that remove their sting for investors create a very real risk of moral hazard. If investors feel less pain from losing money during a bubble crash, experimental evidence would suggest that the learning effects on investors would be compromised.

2. SHORT CIRCUITING POSITIVE-FEEDBACK INVESTMENT LOOPS

a. Restricting access of unsophisticated investors and "tiering"

Much of the same evidence that questions the effectiveness of disclosure and investor education also draws into question whether policies that restrict access of certain investors to markets will mitigate mispricings. More precisely, this evidence calls into question assumptions of who should be restricted from riskier markets. Given the propensity of small-business people, corporate executives, and securities dealers to create bubbles in experiments,[251] existing categories for tiering investors may have faulty assumptions. Securities-law exemptions that rely on high-net-worth and "financial-sophistication" standards to provide less information and protection to certain investors[252] may not be tailored properly.

Who would fall within an optimal sophisticated-investor category remains unclear. There is a tension in behavioral-finance literature: On the one hand, behavioral finance often differentiates between irrational noise traders and "smart money," or arbitrageurs.[253] On the other hand, many behavioral-finance studies document behavioral biases in securities professionals and arbitrageurs who would fall into the smart-money camp.[254]

"Noise traders" and "smart money" are useful theoretical constructs for models, but formulating policy based on this distinction

251. *Supra* note 222 and accompanying text.
252. *Supra* notes 162–64 and accompanying text.
253. *See, e.g.*, SHLEIFER, *supra* note 35, at 172.
254. *E.g.*, La Blanc & Rachlinkski, *supra* note 125, at 570–74.

requires much more evidence of which types of investors fall into which category. Much work remains in constructing a more nuanced (perhaps even demographic) profile of noise traders, and experimental economics could prove a valuable tool. Some experimental-asset-market studies have already attempted to screen traders based on personality and risk preference and then measure which traders drive bubble prices.[255] Further-nuanced studies could attempt to draw correlations in which certain experiment subjects (1) exhibit specific behavioral biases in the context of basic behavioral experiments of the type that documented the heuristics and behavioral biases outlined in Part II.B.2,[256] (2) exhibit certain patterns in brain-imaging experiments, and then (3) pay bubble prices in experimental asset markets. Being able to categorize investors might also enable scholars to investigate whether certain antibubble laws, even if generally ineffective, might work with certain classes of investors.

b. Transaction and capital-gains taxes

An array of evidence suggests that transaction and capital-gains taxes will have mixed results in preventing bubbles. In one experimental asset market, a moderate transaction tax[257] did not eliminate bubbles or reduce their duration, but it did reduce the amplitude of a bubble.[258] Oddly, this transaction tax increased the turnover of shares for traders inexperienced with the experiments.[259] In another experiment, a fifty-percent–capital-gains tax likewise did not reduce the tendency of bubbles to occur.[260]

This experimental evidence accords with the observation by one economist that real-estate markets, which have higher transaction costs than stock markets, still experience bubbles.[261] Moreover, countries that

255. Shyam Sunder, *Experiment Asset Markets: A Survey*, *in* THE HANDBOOK OF EXPERIMENTAL ECONOMICS 445, 489 (John H. Kagel & Alvin E. Roth Sunder eds., 1995) (summarizing one set of studies).

256. *Supra* notes 88–91.

257. King et al., *supra* note 24, at 190. One experiment charged an exchange fee of $0.20 on each transaction, split equally between buyer and seller. To give a sense of the reasonableness of this tax, the intrinsic value of one share started at $3.50 at the beginning of the experiment and declined linearly to zero at the end of fifteen trading periods. Assuming turnover of six-times total shares, $0.20 represents an average cost of $1.20 per share. *See id.*

258. *Id.*

259. *Id.* The tax did have the expected effect of reducing turnover by experienced traders. *Id.*

260. Lei et al., *supra* note 209, at 2, 4.

261. SHILLER, *supra* note 15, at 227; *see also* James R. Repetti, *The Use of Tax Law to Stabilize the Stock Market: The Efficacy of Holding Period Requirements*,

impose higher transaction costs on trades do not seem to enjoy less stock-market volatility.[262] Of course, at a high-enough rate, transaction taxes will deter speculation but at the potential cost of choking-off liquidity in the market.

Proponents argue that these taxes will affect short-term speculators more than long-term investors given that short-term speculators base their decision on price behavior for more recent and narrower time windows than long-term investors.[263] But arbitrageurs are by nature also short-term speculators, and transaction taxes would also impose additional costs on arbitrageurs and could thus deter them from correcting mispricings. Analyzing the relative effects of transaction taxes on noise traders compared to arbitrageurs would require an analysis of the relative elasticities of demand for an asset for each group. Given the long-running debate about the slope of demand curves for stocks in general,[264] it is unlikely a consensus will emerge on this question any time soon. Nonetheless, the surprising evidence from experimental asset markets—that transaction taxes actually increase stock turnover among inexperienced traders but decrease turnover for experienced traders[265]—does not suggest that transaction taxes can target noise traders and avoid arbitrageurs.

c. Circuit breakers

In both experiments and empirical studies, circuit breakers and reverse circuit breakers appear to do little to prevent or mitigate bubbles and often appear to exacerbate mispricings. Experimental asset markets have introduced limited price-change rules similar to those imposed by stock and futures markets. Specifically, trading is halted if prices decline or rise beyond a set band around the price in a previous trading period.[266] Researchers have found that these rules exacerbate the

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8 VA. TAX. REV. 591, 627–30 (1989) (arguing that holding-period requirements of long-term–capital-gains-tax preferences and short-sale restrictions are not justified as ways to deter speculation and may reinforce irrational investing and mispricing). Other tax rules might help address mispricing during a bubble, but further study is needed.

262. Richard Roll, *Price Volatility, International Market Links, and Their Implications for Regulatory Policies*, 3 J. FIN. SERVS. RES. 211, 238 (1989).

263. SHILLER, *supra* note 15, at 227.

264. For one early salvo in this debate, see Andrei Shleifer, *Do Demand Curves for Stocks Slope Down?*, 41 J. FIN 579 (1986).

265. *See supra* note 257 and accompanying text.

266. King et al., *supra* note 24, at 194–95. The price band used in the experiment was plus or minus thirty-two cents (which equaled twice the expected dividend for any period). *Id.* at 195.

magnitude of mispricings above fundamental value when compared to baseline experiments.[267]

Empirical evidence also does not support the effectiveness of circuit breakers in staving-off or mitigating price bubbles. Circuit breakers that shut markets down for short periods of time are designed to provide a cooling-off period for massive, short-term price swings; they are not designed and remain unproven as a device for preventing long-term mispricings, such as an extended stock-market bubble.[268]

d. Other resale restrictions

Evidence that holding periods that restrict resale of assets prevent or mitigate the severity of bubbles is also very weak. On the experimental side, one experimental asset market completely forbade resale, yet a bubble still formed with results mirroring other experimental asset markets.[269] This result not only calls into question the effectiveness of holding periods and other resale restrictions but also conflicts with the theory that bubbles are driven by expectations of capital gains (i.e., investors drive up prices because they are following a "greater-fool" strategy).[270]

3. ENABLING ARBITRAGE

Experimental and empirical evidence suggests that short sales can only prevent or dampen bubbles if a number of conditions are met. In an experimental asset market that allowed a minority of "more sophisticated" traders to engage in short sales,[271] bubbles still formed.

267. *Id.* at 195. The experimenters posited that the circuit breaker "accentuates the severity of bubbles because traders perceive that their downside risk is limited by the 32 or 48 cent bounds on price declines in each period." *Id.* Only when the experiment was rerun with traders "experienced" with previous experimental iterations, did prices track fundamental value. But, this was the same result as in baseline experiments comparing inexperienced and experienced traders without a circuit breaker, which suggests that it is the experience of past bubbles and crashes, not circuit breakers, that prevents mispricings. *Id.*; *see also* Lucy F. Ackert et al., *An Experimental Study of Circuit Breakers: the Effects of Mandated Market Closures and Temporary Halts on Market Behavior*, 4 J. FIN. MARKETS 185 (2001) ("[The] presence of a circuit breaker rule does not affect the magnitude of the absolute deviation in price from fundamental value . . . .").

268. SHILLER, *supra* note 15, at 226.

269. Lei et al., *supra* note 137, at 841–45.

270. *Id.*

271. One experiment placed three graduate students who had read earlier experimental asset studies (labeled "insiders") in a market with six to nine undergraduates who had not read the studies ("outsiders"). Insiders and outsiders had the same share endowments, but insiders could sell two shares borrowed from

Additionally, in some experiments the magnitude and duration of mispricing during a bubble increased.[272] Reviewing the short-sale experiments, some of the experimenters noted that the "bubble forces are so strong that the insiders[273] are swamped by the buying wave."[274] Results from other experimental-asset-market studies also document the limited effectiveness of short sales in preventing or dampening bubbles.[275]

The conclusions from the short-sale experiments must remain tentative since it is possible that these experiments may have overly constrained short selling.[276] In particular, with only one security being traded on the market, traders selling short could not hedge by purchasing substitute securities.[277] Nevertheless, the constraints imposed on short selling in these experimental asset markets do not deal a fatal blow to the parallelism of these experiments. Again, arbitrage, and short selling in particular, faces real-world limitations as well.[278] This empirical evidence of the limits of arbitrage, other than legal restrictions on short selling, together with the experimental evidence above suggests that removing legal barriers to short selling may not

experimenters. Each of these shares had to be repurchased and repaid to the experimenters or a penalty of one-half the initial dividend value would be imposed on each share not repaid. It is unclear what the initial share endowment was. Caginalp et al., *supra* note 131, at 27.

272. King et al., *supra* note 24, at 186–88. When short-sale experiments were rerun to give traders experience, bubble magnitude decreased. However, as with the circuit-breaker experiments, it appears as if experience, not short sales, was the primary factor mitigating mispricings. *See id.* at 188–89, 199.

273. The insiders were the graduate students who were informed of past experimental-asset-market research and had the capability of selling short, as described above in note 263.

274. Caginalp et al., *supra* note 131, at 27–28.

275. *See* Sunder, *supra* note 255, at 448 (surveying other experimental asset markets that tested for effects of short selling).

276. Conclusions on the limited effectiveness of short selling in reducing bubbles could be made more robust by rerunning these experiments and changing the parameters to further decrease the costs of short selling. For example, the experiment could be rerun with the following parameters varied: (1) increasing the number of shares the short sellers could borrow (it is difficult to interpret the results of the initial survey because, while the number of shares that could be borrowed (two) is known, the share endowments of each trader is not disclosed); (2) decreasing the penalty for not repaying shares borrowed; (3) increasing the proportion of traders that could sell short compared to the total number of traders; and (4) increasing the time horizon of the short sellers.

277. The ability to purchase substitute securities allows arbitrageurs to mitigate risk and is therefore critical to fully effective arbitrage. SHLEIFER, *supra* note 35, at 3–4.

278. *See supra* notes 98–104 and accompanying text.

have a significant impact on preventing, pricking, or dampening bubbles.

4. INCREASING THE COSTS OF BORROWING: MARGIN

Experimental asset markets that introduced the opportunity for traders to purchase shares on margin increased the amplitude of bubbles with inexperienced traders compared to baseline experiments.[279] "This suggests that the common social policy of imposing margin requirements may be effective in moderating stock market bubbles."[280] This accords with general empirical evidence on the effectiveness of tightening credit on preventing and pricking asset-price bubbles.[281]

Although experimental evidence suggests that margin regulations are targeting the right incentives, the empirical evidence supporting the effectiveness of actual margin regulations in the United States[282] to reduce speculation ranges from weak to inconclusive.[283] One possible explanation of this limited effectiveness is that margin regulations may be poorly designed. Margin regulations only prevent the extension of credit to investors by certain lenders;[284] investors continue to enjoy other avenues of credit for purchasing stock.[285]

IV. THE COSTS OF BUBBLES V. THE COSTS OF ANTIBUBBLE LAWS

This Article has considered only the question of whether antibubble laws would be effective. This leads to a larger question of whether even effective antibubble laws are justified. To answer this, this Part outlines the elements of a very rough cost-benefit analysis.

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279. King et al., *supra* note 24, at 188–89. The results are more mixed in experiments in which traders could both buy on margin and sell shares short. *Id.* Allowing traders to gain experience by repeating the margin-buying experiments forced prices to closely track fundamentals, but, again, this result did not significantly differ from the baseline, which bolsters the inference that experience with bubbles and crashes was the key determinant in reducing mispricing. *Id.*

280. *Id.* at 199.

281. *See supra* Part II.E.

282. *E.g.*, 12 C.F.R. § 220 (2007).

283. *See* OFFICE OF TECH. ASSESSMENT, U.S. CONG., ELECTRONIC BULLS AND BEARS: U.S. SECURITIES MARKETS AND INFORMATION TECHNOLOGY 86 (1990); BD. OF GOVERNORS OF THE FED. RESERVE SYS., A REVIEW AND EVALUATION OF FEDERAL MARGIN REGULATIONS 44–50, 85–91 (1984); Stephen Figlewski, *Margins and Market Integrity: Margin Setting for Stock Index Futures and Options*, 4 J. FUTURES MARKETS 385 (1984).

284. Regulation T, the principal margin regulation, only covers extensions of credit by brokers and dealers. 12 C.F.R. §§ 220.1–.130.

285. Stout, *supra* note 173, at 730–31.

Section A catalogues the potential economic costs posed by asset-price bubbles and addresses the reasons why scholars propose that policymakers implement antibubble laws. Section B provides a rough inventory of the costs of antibubble laws themselves.

A. The Costs of Asset-Price Bubbles

The formation of asset-price bubbles poses significant economic costs, which can be placed into three categories. First, mispriced assets translate into the misallocation of economic resources; high prices in an overvalued asset class divert capital from economic sectors that are not overvalued.[286] Professor Marcel Kahan explores the nuances of the economic costs of mispricing and creates a comprehensive typology of the various costs of inaccurate prices in the stock market.[287] Kahan details the ways and conditions under which various forms of mispricing may lead to inefficient capital allocation,[288] liquidity reduction,[289] increased risk,[290] and skewing the incentives of management.[291] These costs could escalate dramatically as the extent of mispricings increases during a stock-market bubble.[292]

Second, the dynamics of an inflating asset-price bubble promote fraud and other lawbreaking. Scholars have argued that the rise of asset bubbles throughout different historical periods and countries has been

286. For an extended discussion of the inefficient allocation of resources that bubbles can cause in emerging markets, see Carlos Massad, *Capital Flows in Chile: Changes and Policies in the 1990s*, *in* FINANCIAL GLOBALIZATION AND THE EMERGING ECONOMIES 219, 219–223 (José Antonio Ocampo et al. eds., 2000).

287. Kahan, *supra* note 21, at 988.

288. Overpriced shares allow companies to raise capital for unprofitable projects (and underpriced shares may deny funding for profitable projects). *Id.* at 1005–06.

289. Market liquidity may suffer if investors are risk averse to losses from inaccurate prices. *Id.* at 1017. In its worst form, this liquidity reduction manifests itself as a crisis in investor confidence and can precipitate a liquidity crunch (discussed in greater detail below). *See infra* notes 288–89 and accompanying text. A liquidity crunch can lead to further inaccuracies in stock prices. *See* Kahan, *supra* note 21, at 992.

290. Inaccurate stock prices may increase stock volatility, and risk-averse investors may not be able to hedge this risk through diversification. Kahan, *supra* note 21, at 1025–28.

291. Mispricings may create perverse incentives for managers to take actions that raise the stock prices of their company even when those actions would lower the company's fundamental values. *Id.* at 1028–34. Kahan also summarizes the circumstances in which mispricings may skew the market for corporate control, lead to inefficient terms in contracts between shareholders and managers, and lead to inefficient capital budgeting by companies. *Id.* at 1034–41.

292. *Id.* at 990–92.

accompanied by epidemics of financial fraud in both stock[293] and real-estate markets.[294] In fact, the dynamics of asset-price booms promote financial fraud.[295] Widespread fraud, in turn, can contribute to a crisis of investor confidence.[296]

Third, the bursting of a bubble often has dramatic spillover effects beyond the specific asset market where prices crashed. Stock or real-estate price crashes can lead to a severe credit crunch,[297] a term that is now part of the national vocabulary given the recent subprime-mortgage crisis.[298] Falling prices and tightening credit can erode investor confidence[299] and cause severe economic damage.[300] Economists worry that the collapse of an asset-price bubble can lead to contagion, which describes how falling prices in one asset market can cause price collapses and financial instability across other asset classes as well as international borders.[301] Economists worry that many of the same phenomena that may contribute to the rise of asset-price bubbles—for example, behavioral biases and feedback loops—reverse dramatically and destructively during a bubble's collapse.[302]

Some economists believe that some asset-price bubbles do not end in a dramatic price crash but in slower downward leak or stagnation.[303] This presents a Faustian tradeoff between the costs of persistent

293. KINDLEBERGER, *supra* note 37, at 73–90 (surveying historical swindles in stock and other financial markets during bubbles); Erik F. Gerding, *The Next Epidemic: Bubbles and the Growth and Decay of Securities Regulation*, 38 CONN. L. REV. 393, 405–13 (2006).

294. Marc A. Weiss, *The Politics of Real Estate Cycles*, 20 BUS. & ECON. HIST. 127, 128 (1991), *available at* http://www.h-net.org/~business/bhcweb/publications/BEHprint/v020/p0127-p0135.pdf (stating that the excesses of real-estate bubbles may include outright business fraud).

295. Gerding, *supra* note 293, at 424–41.

296. Tamar Frankel, *Regulation and Investors' Trust in the Securities Markets*, 68 BROOK. L. REV. 439, 447–48 (2002); Lynn A. Stout, *The Investor Confidence Game*, 68 BROOK. L. REV. 407, 411–12 (2002).

297. *E.g.*, Michael D. Bordo & Olivier Jeanne, *Boom-Busts in Asset Prices, Economic Instability, and Monetary Policy* 11 (Nat'l Bureau of Econ. Research, Working Paper No. 8966, 2002), *available at* http://www.nber.org/papers/W8966.pdf.

298. Vikas Bajaj et al., *Central Banks Intervene to Calm Volatile Markets*, N.Y. TIMES, Aug. 11, 2007, at A1.

299. Ben Bernanke & Mark Gertler, *Monetary Policy and Asset Price Volatility* 29 (Nat'l Bureau of Econ. Research, Working Paper No. 8966, 2000), *available at* http://www.nber.org/papers/W7559.pdf.

300. *E.g.*, Paul Krugman, *Dutch Tulips and Emerging Markets*, FOREIGN AFFAIRS, July–Aug. 1995, at 28.

301. DIDIER SORNETTE, WHY STOCK MARKETS CRASH: CRITICAL EVENTS IN COMPLEX FINANCIAL SYSTEMS 309–13 (2003)

302. *Id.* at 310.

303. *Supra* note 148 and accompanying text.

mispricings outlined by Kahan and the costs of asset-price crashes with all the potential spillover effects mentioned above.

Beyond immediate economic-efficiency costs, the bursting of asset-price bubbles can cause severe social dislocation.[304] The rise and collapse of asset prices also leaves winners and losers. The equitable effects will depend in large part on which social groups invested in the asset class, who was "smart money" (i.e., buying low and selling high) and who did not sell before the crash.

Bursting asset-price bubbles have also sparked the generation of the most far-reaching financial laws.[305] Whether these new laws represent the evolution of financial law through punctuated equilibria, or a perverse pattern of underregulation during the rise of bubbles and re-regulation (and possible overregulation) after the burst of bubbles, remains open to debate.[306]

B. The Costs of Antibubble Laws

Given the potentially severe costs of bubbles, policy makers could take the position that it is worth trying even unproven antibubble laws. Many of these laws, however, carry their own costs and risks.

1. DANGERS OF PRICKING

For example, the wisdom of pricking bubbles, even if policymakers could, is highly questionable. Policymakers face the initial problem of determining whether a bubble exists,[307] which, again, remains more art than science.[308] Assuming policymakers are comfortable in their ability to detect bubbles, pricking bubbles can precipitate asset-price crashes with all the negative spillover effects described above.[309] Moreover, pricking asset-price bubbles can pose

304. For a survey of the historical and cultural effects of the bursting of asset-price bubbles, see CHANCELLOR, *supra* note 56.

305. *See* Stuart Banner, *What Causes New Securities Regulation?: 300 Years of Evidence*, 75 WASH U. L.Q. 849, 850 (1997).

306. *Compare* Joseph A. Grundfest, *Punctuated Equilibria in the Evolution of United States Securities Regulation*, 8 STAN. J.L. BUS. & FIN. 1 (2002), *with* Gerding, *supra* note 293, at 423–24. For a description of the cycle of the politics of regulation during the rise and fall of real-estate booms, see Weiss, *supra* note 294, and Larry E. Ribstein, *Bubble Laws*, 40 HOUS. L. REV. 77, 79–83 (2003).

307. *See* Miller, *supra* note 175, at 1055.

308. *See supra* Part II.A.4, C.1.

309. *Supra* notes 297–302 and accompanying text.

dire political risks for those seen as responsible for upsetting the economic applecart.[310]

2. DANGERS OF PREVENTING OR DAMPENING ASSET-PRICE BUBBLES

Even laws that would prevent—not prick—bubbles entail serious costs. Professors Gregory La Blanc and Jeffrey Rachlinski have advanced several arguments against laws that would restrict the impact of noise traders on financial markets.[311] Their arguments apply to antibubble laws as well.

First, they argue that restricting noise traders from investing would deny markets valuable price information contained in the trades of these investors.[312] La Blanc and Rachlinski assume, however, that noise traders are, on average, correct and that noise-trader mistakes cancel each other out.[313] But evidence from behavioral finance suggests that noise traders often do not cancel, but rather exacerbate, one another in positive-feedback trading loops.[314]

La Blanc and Rachlinski raise a second argument, namely that investor irrationality benefits asset markets since noise traders provide liquidity to markets.[315] Many antibubble laws are, in fact, designed to deny liquidity to the market.[316] Advocates of these laws might argue that increasing the cost of raising capital is desirable when markets suffer from excessive liquidity; antibubble laws may be a necessary and sobering tonic that refocuses investors away from short-term–positive-feedback investing and towards sustainable long-term investments.[317] But this response invites the questions of how much liquidity is too much, how to distinguish between valuable investment and disfavored speculation, and where is the appropriate line between disfavored short-term and favored long-term investment strategies.[318]

The difficulty differentiating between short-term and long-term strategies points to a third cost of antibubble laws (not raised by La

310. *See* Miller, *supra* note 175, at 1055.

311. La Blanc & Rachlinski, *supra* note 125, at 565–78.

312. *Id.* at 567–70.

313. *Id.* at 568.

314. *See supra* Part II.B.2.b.

315. La Blanc & Rachlinski, *supra* note 125, at 565–67.

316. *Supra* note 11 and accompanying text.

317. Gabaldon, *supra* note 9.

318. For an article critical of attempts to cure excessive speculation, see Mahoney, *supra* note 154. For an article that highlights the tradeoffs in securities law between serving investors with short-term horizons and those with long-term horizons, see Steven L. Schwarcz, *Temporal Perspectives: Resolving the Conflict Between Current and Future Investors*, 89 MINN. L. REV. 1044 (2005).

Blanc and Rachlinski): by attempting to stifle short-term speculation, these laws may prevent arbitrageurs and others from engaging in short-term strategies that would correct mispricings.[319]

La Blanc and Rachlinski highlight a fourth concern: increasing the cost of raising capital from noise traders may drive companies to debt markets. La Blanc and Rachlinski argue that the financial professionals who make lending decisions suffer from many of the same behavioral biases that afflict individual equity investors.[320] Debt markets also involve high agency costs, which some economists argue lead to the formation of asset-price bubbles.[321] In fact, La Blanc and Rachlinski cite several economic studies that found asset-price bubbles arising even in markets where decisions are made by financial professionals as opposed to less sophisticated individual investors.[322]

Not all antibubble laws involve interventions in markets. Removing short-sale restrictions actually reduces government involvement in securities markets. But some commentators have noted that short sales have potential risks, particularly during panics and cascading defaults.[323] Fully enabling arbitrage brings its own set of risks; some financial analysts worry that the SEC's repeal of the uptick test in July 2007 exacerbated financial-market volatility later that summer.[324]

3. LEARNING TO LOVE BUBBLES?

A more subversive critique of efforts to prevent asset-price bubbles is that bubbles mobilize investments in long-lasting commercial infrastructure that otherwise might not have been built. This argument contends that the destructive creativity of bubbles has given countries extended networks of canals, railroads, air travel, radios, television, and the Internet, as well as the human capital to run these networks.[325]

319. SHLEIFER, *supra* note 35, at 97–102 (describing the benefits of arbitrage).

320. La Blanc & Rachlinski, *supra* note 125, at 570–74.

321. *See supra* note 73 and accompanying text.

322. La Blanc & Rachlinski, *supra* note 125, at 575–76.

323. Powers et al., *supra* note 13, at 246–49 (outlining potential benefits of short sale restrictions).

324. Emily Chasan, *Analysts Fear Shorting Effect*, GLOBE & MAIL (Toronto) Aug. 10, 2007, at B12. Given the recency of this repeal, conclusions on its effects remain premature.

325. For an accessible articulation of this argument, see DANIEL GROSS, POP!: WHY BUBBLES ARE GREAT FOR THE ECONOMY (2007).

V. CONCLUSION

Given the numerous costs of antibubble laws, policymakers should hesitate before implementing a law with questionable effectiveness absent other policy justifications for the law. Experimental and empirical evidence suggests that many antibubble laws might be ineffective or even counterproductive at preventing bubbles or dampening the severity of asset mispricings during bubbles.

This conclusion does not argue for repeal of antibubble laws. First, even if they do not eliminate severe mispricings during a bubble, existing antibubble laws may be effective in correcting less drastic mispricings.[326] But any reduction in the probability or scope of mispricing would have to be balanced against the costs of antibubble laws. Second, many antibubble laws and policies have purposes beyond preventing asset-price bubbles, and their effectiveness in achieving these other purposes must be evaluated separately.

Experimental asset markets can serve as a valuable tool in analyzing the effectiveness of securities laws in meeting objectives other than remedying asset-price bubbles. This Article has provided a model for evaluating evidence from experimental economics that can be used for analyzing the effectiveness of a range of other securities and financial rules. Indeed, experimental economists have moved beyond bubbles. Recent research in experimental asset markets has focused on a broad range of financial-regulatory topics, including the impact of corporate-takeover rules, antifraud rules, and securities-disclosure rules.[327] Moreover, as Kahan notes, many regulations beyond antibubble laws are concerned with promoting "accurate" prices in financial markets.[328] The ability of economists to measure with certainty the "accuracy" of prices in experimental asset markets provides all the more reason for legal scholars to add experimental-asset-market research to their toolbox.

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326. Although many definitions in the economic literature, including those found in experimental-asset-market research, might consider any departure from fundamental value a bubble, this Article, like the experimental-asset-market research it cites, does not consider small deviations of price from fundamental value to be a bubble.

327. *E.g.*, Charles Bram Cadsby et al., *Pooling, Separating, and Semiseparating Equilibria in Financial Markets: Some Experimental Evidence*, 3 REV. FIN. STUD. 315 (1990); Robert Forsythe et al., *Cheap Talk, Fraud, and Adverse Selection in Financial Markets: Some Experimental Evidence*, 12 REV. FIN. STUD. 481 (1999); Jayant R. Kale & Thomas H. Noe, *Unconditional and Conditional Takeover Offers: Experimental Evidence*, 10 REV. FIN. STUD. 735 (1997); Robert Libby et al., *Experimental Research in Financial Accounting*, 27 ACCT. ORG. & SOC'Y 775 (2002).

328. Kahan, *supra* note 21.

Of all four categories of antibubble laws, restricting credit is the most effective method of preventing, pricking, or dampening bubbles.[329] However, empirical data questions the effectiveness of margin regulations, the prime example of this type of antibubble law, in real-world markets.[330] This may be explained by limitations on the scope of margin regulations, which allows investors and intermediaries to sidestep restrictions and obtain credit for stock purchases from other sources.[331]

Monetary policy, although not typically a subject for legal scholarship, appears to be effective in preventing, pricking, and dampening asset-price bubbles. But monetary policy serves as an extremely blunt instrument to correct asset prices.[332] Monetary policy can have many goals, including targeting inflation, stimulating economic growth, and maintaining balances between foreign currencies.[333] Using monetary policy to address asset mispricings can thus have unintended ripple effects throughout the economy.[334] This has led to a heated debate among macroeconomists and central bankers about the wisdom of using monetary policy to target asset mispricing.

The differences in effectiveness between margin regulations and monetary policy creates a dilemma. Margin regulations can narrowly target credit that spurs the inflation of a specific asset class, but its narrow tailoring allows investor opportunism that limits the policy's effectiveness. Monetary policy eliminates this opportunism by raising interest rates more broadly, but this broad reach creates unintended spillover effects. This dilemma argues for greater study into the role that other legal mechanisms have on restricting or expanding credit, such as bankruptcy laws,[335] and prudential regulations that limit the ability of financial institutions to invest (or lend to investors) in the securities or housing markets.[336]

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329. *Supra* Part III.C.4.

330. *See supra* notes 282–83 and accompanying text.

331. *See supra* notes 284–85 and accompanying text.

332. Miller, *supra* note 175, at 1053–55.

333. *Id.*

334. *Id.*

335. One interesting question is whether bankruptcy laws that reduce the protections of debtors from creditors may overstimulate lending and, in turn, leveraged purchases of assets. For example, what impact did the recent Bankruptcy Abuse Prevention and Consumer Protection Act, Pub. L. No. 109-8, 119 Stat. 23 (codified under Title 11 of the U.S. Code), have on lending from financial institutions to individuals investing in homes? Did that law contribute to the recent subprime-mortgage crisis?

336. Members of Congress reacted to the potential threat of a credit crunch posed by the subprime-mortgage-lending crisis. For example, Senator Schumer argued

This dilemma points to a greater implication. Given evidence that prophylactic laws designed to prevent, prick, or dampen bubbles may be ineffective, counterproductive, or unduly costly, policymakers and scholars should focus on the effectiveness of financial laws designed to make the economy more resilient to asset-price crashes. These laws include prudential regulation of financial institutions; government-sponsored deposit-insurance programs; and social insurance, such as Social Security.[337] Experimental asset markets are a valuable tool to evaluate the effectiveness of these laws as well.

One conclusion from the experiments described above already presents itself: a distinction must be made between regulations that promote resiliency generally by forcing investors or institutions to hold certain funds in reserve out of a booming market and those that attempt to bail out investors who have suffered losses in a bubble crash. Bailouts might remove too much of the sting from a crash and thus negate the prophylactic effect demonstrated by experimental asset markets that investor "experience" of a bubble crash can have on preventing future bubbles. Experimental asset markets underscore the cost of moral hazard.

But experimental economics is not merely a tool for testing policy recommendations. It can also sharpen and reshape theoretical work on bubbles and asset pricing in general. This Article presents, in a linear fashion, a path from definition, to theory, to policy, to empirical and experimental evaluation of that policy. A better metaphor might be a loop in which evidence from the laboratory and field feeds back into refinements of theories. For example, the fact that bubbles still formed in experimental asset markets that prohibited resale suggests that bubbles may be driven by more than just investor expectations that flipping assets will lead to capital gains.[338] Building and testing economic theories is an iterative process.[339]

Developing better theories, as well as better empirical and experimental tests, requires careful consideration of the differences between modeling decision making under risk compared to decision

for easing the regulations restricting the levels of mortgages that Freddie Mac and Fannie Mae may purchase (and ultimately securitize) to inject liquidity into the prime-mortgage market. Eric Dash, *Fannie Mae's Offer to Help Ease Credit Squeeze Is Rejected, as Critics Complain of Opportunism*, N.Y. TIMES, Aug. 11, 2007, at C1 (reporting that the regulator of Freddie Mac and Fannie Mae rejected this proposal).

337. Carmichael & Esho, *supra* note 232, at 481 (discussing interaction of financial institution regulation and asset-price bubbles); SHILLER, *supra* note 15, at 220–22 (analyzing Social Security reform in light of recurring asset-price bubbles).

338. Lei et al., *supra* note 137.

339. For a compelling argument on the way theory, experimental research, and empirical inquiry should work together, see Smith, *supra* note 33, at 923–34.

making under uncertainty. This crucial difference has remained underexplored in both legal and economic research, yet modeling decision making under uncertainty is at the cutting edge of economic research. Economists are refocusing on basic research regarding decision making under uncertainty in order to improve economic models.[340]

It would be dangerous to make assumptions regarding where this research might lead. Accordingly, evidence of the imperfection of markets does not necessarily justify market interventions. In fact, much of the experimental and empirical evidence that supports the possibility that bubbles recur in real-world asset markets also draws into question whether policy interventions can do much to remedy this. Nonetheless, this Article corrects a popular oversimplification that behavioral-finance and behavioral-law-and-economics scholarship always support intervention to address market failures.[341]

340. Professor Athey, for example, has created models for decision making under conditions of uncertainty that show how individuals value and react to increased information. Susan Athey, *Monotone Comparative Statics Under Uncertainty*, 117 Q.J. ECON. 187 (2002).

341. *See supra* note 29 and accompanying text.