

# MARKET BUBBLES **AND CRASHES**

A Whitepaper for CPA Ontario

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# Summary

## **Bubbles may be persistent throughout human history, but accountants can play their part in preventing or curbing the worst excesses.**

Bubbles occur when investors trade on the basis of the market value of an asset, rather than on the business value it creates. Believing that someone, somewhere will pay more for the asset in future, expert and non-professional traders can be drawn into investing based on upward market trends, fueling upwardly spiraling prices. Cheap credit only serves to exacerbate the bubble.

Although accountants may not be directly responsible for bubbles, they can contribute to their development. The complexities of accounting can cause fluctuating asset valuations, encouraging investors to believe prices will rise. Additionally, when assets are valued at market rates in company accounts, their fundamentals can appear stronger than they are, which again feeds investor frenzy.

This paper examines how and why bubbles evolve, and considers what accountants can do to try to prevent bubbles, or at least reduce their frequency and magnitude.

## **Highlights**

### **Bubbles have consistent themes:**

- The assets underlying the bubble were bought and sold many times before being used
- Ready availability of investment capital adds to the problem
- Many untrained investors are drawn into the bubble, increasing speculation

### **Investor behavior is hard to predict:**

- Investors tend to overestimate what others will pay for an asset
- Investments can be mispriced due to an asset's market price deviating from its fundamental value
- By relying on market trends to value assets, investors continually elevate the price, creating a bubble

### **What can accountants do to help?**

Our research suggests that historical cost accounting – as opposed to marking to market – can reduce the potential and subsequent impact of bubbles and crashes. Accountants can provide better accounting information, emphasizing an asset's true, fundamental value, and remain cautious about market-based estimates of asset value, helping clients to recognize the warning signs of impending boom-and-bust cycles.

# Market bubbles and crashes

## A persistent and ‘human’ challenge

In the mid-1980s a team of economists studied how small groups of people interacted in very simple markets with as few as ten people, and that lasted only a very short time. The scientists designed a setting that they believed would be ‘bubble-proof’.<sup>1</sup> Everyone in these markets had the same information, trading a single stock that was easy to value (similar to a high-stakes coin toss game). To the surprise of the economists (and, indeed, other experts), market price bubbles formed even in these ‘bubble-proof’ markets. In several cases, market prices not only surpassed the simple stocks’ probable payoffs but also exceeded the highest payout that the coin tosses could *possibly* yield. That is, market bubbles formed even in these very small, stark settings that eliminated many of the most common explanations for bubbles. The results left the scientists puzzled: why would anyone buy a stock at a price that was higher than the dividends it could yield? And, why would such behavior occur so frequently?

Follow-up studies showed that bubbles occurred among groups of all sizes and expertise (e.g. professional traders and business professionals).

**The persistence of market price bubbles in those settings, just as the persistence of market price bubbles in other ‘real-world’ settings, has shown bubbles to be a robust and very ‘human’ problem; wherever there are people and markets, bubbles arise.**

While it may be easy to blame the problem on the naïve and untrained (and bubbles are no doubt worsened by the participation of such individuals), the fact that bubbles have occurred across time, across all geographies, and across all asset types suggest that the challenge may also be structural.

## Bubbles past, bubbles present

There is a rich and colorful history of market bubbles, from Dutch ‘Tulipmania’ in 17th century Holland, to the Mississippi Bubble (France) and the South Sea Bubble (England), which both followed offerings of shares in exclusive colonial trade companies. Over the last century, the US experienced a series of bubbles, including the 1920s market bubble leading up to the Wall Street crash of 1929, triggering the Great Depression. More recently, the dotcom bubble and the US real estate bubble both preceded market crashes and multi-year economic recessions. In other parts of the world, real estate bubbles occurred in 1980s Japan, and 2000s China and South Africa.

**In short, market bubbles appear to have existed for as long as markets have been around, spanning time periods, geographies, markets, and asset types.**

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<sup>1</sup> Smith, Suchanek, Williams (1988) “Bubbles, crashes, and endogenous expectations in experimental spot asset markets” *Econometrica*.

Several common themes connect these bubbles. The assets underlying the bubble were often bought and sold many times before being used, with investors trading against some market-based value rather than fundamentals (the money that the underlying business or asset would generate). In many cases, growing availability of investment capital (liquidity) added to the problem – and was also created by the bubble – fanning the self-reinforcing mania. In the largest bubbles, many untrained investors were also drawn into the action, further amplifying the bubble, and often failing to understand the associated risks until it was too late. When the inevitable crashes arrived, these bubbles frequently triggered economic recessions that spanned multiple years, as investors and institutions alike faced a sudden loss in wealth. These spectacular bubbles may make history, but numerous smaller versions rise and fall throughout the world every day.

## What is (and is not) a market bubble?

Defining a market bubble is harder than it seems. Rapid price increases and crashes can occur for a number of reasons and don't *necessarily* indicate a bubble. For instance, the dramatic fall in worldwide markets during COVID-19 didn't necessarily suggest a bubble; rather that we had (rationally) priced a pandemic-free future until the virus arrived, leading us to revise our expectations, to include the consequences of social distancing (less commercial activity, greater unemployment, etc.).<sup>2</sup>

An investment is *mispriced* whenever its market price deviates from its 'fundamental value' (the money generated by the underlying business). A *market bubble* is a type of mispricing where price rises faster than is warranted by new information about its fundamental value. This rapid price rise – and subsequent collapse – suggests that price reflected some source of value other than fundamental value, which we discuss in greater detail below. The defining attribute of market bubbles is a self-reinforcing upward price trend, as the market anticipates higher prices, with investors believing that some other person(s) will pay more for the asset.<sup>3</sup>

Diagnosing a bubble often calls for hindsight, due to the difficulty in identifying whether any market or asset is *currently* displaying irrational exuberance, rather than making rational judgements based upon reliable information. We discuss this problem further in the section ('Is 'X' in a bubble?').

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<sup>2</sup> Also, while market bubble crashes are often linked with larger financial crises, they are by no means the only source of financial crisis. For instance, hyperinflation, systemic fraud (for instance, the Texas Savings & Loan scandal of the 1980s), and liquidity crises can all exist without market bubbles.

<sup>3</sup> This core idea is best known as 'the bigger fool theory' – the idea that buying into a bubble is justified if some bigger fool is willing to buy from you at an even higher price. Bigger fool theory stems from logic first described in 'Keynesian Beauty Contests', where judges in a contest needed to guess which contestant the other judges would favor, rather than objectively evaluating beauty for themselves.

# Why are bubbles so persistent?

**Bubbles require only two things: 1) people, and 2) a belief that someone, somewhere, sometime, will pay an even higher price.<sup>4</sup>**

They reflect the very human difficulty of approximating others' beliefs, particularly their extreme beliefs. To understand this better, we use logic developed in models exploring the idea that all market-based assets have *two* sources of value, one of which tends to ignite bubbles. Consider this dilemma:

*You inherit a share of a popular blue-chip stock, currently trading at \$250 per share. Your financial model of the underlying business suggests that the share is worth \$200. However, a friend who covers the industry for an investment bank cautions against selling now because she expects the stock's price to carry upward to \$300 per share.*

**QUESTION:** *If you sell now (at \$250), will you experience a gain relative to your valuation (\$200), or a loss relative to your expectations of higher future market prices (\$300)?*

*That is, will you gain \$50? Or, lose \$50?*

The answer (footnoted below) defies conventional intuition,<sup>5</sup> because assets have *both* a fundamental value and a market-based 'option value'.<sup>6</sup> The fundamental value exists independent of other investors' beliefs; assuming your estimates are correct, your investment entitles you to receive cash flows generated from the underlying business. The option value, in contrast, accepts that price may someday exceed your valuation of the underlying business, enabling you to sell for an amount greater than your estimate of fundamental value. This can occur for both rational reasons (other investors have differing portfolio balancing needs, time horizons, risk preferences, etc.) and also for irrational reasons (market sentiment, noise trading, etc.).

**Most value investing focuses on the fundamental portion of value, ignoring the option portion or treating it as if it were \$0. This is generally reasonable but omits all of the 'logic' that underlies bubbles, making them seem surprising and irrational. In truth, there is a very clear logic.** So long as the probability of achieving some higher price is greater than 0%, then the asset's option value (at least relative to fundamental value) is greater than \$0 and is increasing to a future maximum price. **Thus, between two underpriced stocks (e.g. price is below your estimate of the business's underlying cash flows), the stock with greater volatility comes with an unexpected upside: it may (possibly temporarily) experience an even higher price in future.** However, among overpriced stocks (price is above your estimate of the business's underlying cash flows), the logic is less clear because the potential for price gains must be weighed against the potential for price losses – at least until fundamental value is reached.

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4 In classical finance models, this belief is abstracted away as researchers employ a deductive logic that leads investors to assume that each will arrive at the same valuation. This assumption departs from casual experience where we often observe disagreement, even among knowledgeable experts, and sometimes for no apparent reason other than opposition itself (contrarianism). In a financial context, the presence of differing beliefs greatly changes the task of valuation as explained in this section. In short, when people disagree ('heterogenous beliefs') an analyst should model not only her/his own valuation, but also attempt to reverse engineer the present and future valuations of others.

5 In a sense, you would be experiencing *both* a gain (relative to the stock's fundamental value) and a loss (relative to any higher price, deemed the 'option value') because buying a share gives you both an asset and an option (the right to sell at some future date). However, the true 'option value' is likely to be lower than \$50 because future market price may never reach \$300 (and may even fall below its current price). A more complete answer would adjust the portion associated with future market prices to account for the possibility of other future market prices, for differences in timing, etc.

6 See Harrison and Kreps (1978).

Estimating an investment's option value is very challenging, requiring investors to guess not only what values other investors may assign to an asset, but also what they might guess about one another. Our research suggests that 'crowd wisdom' (see Surowiecki 2005, "The Wisdom of Crowds") generally applies to group guesses of the average estimates by other investors. However, this can be distorted when groups are asked to guess the extreme estimates generated by others. For instance, in a study where we asked people in small groups to guess the number of marbles in a jar, groups guessed the group average relatively accurately (see below). When asked to also guess what the most extreme estimates were, the range became distorted, with many people guessing amounts that were considerably greater than the most extreme actual estimate. Where market investors play a similar 'game' when they try to anticipate the highest price some other investor might pay, our study suggests that they will tend to over-estimate the maximum value.

## EXHIBIT: RESEARCH SUMMARY

**STUDY AT A GLANCE:** We displayed a picture of a jar filled with marbles but did not tell people how many marbles were inside (left column). We asked them to both a) guess how many marbles were in the jar (middle column) and b) guess the highest prediction submitted by another person (right column).

Markets use both types of guessing. Guessing the number of marbles in the jar is similar to guessing fundamental value. When you 'buy' the jar, you will receive however many marbles are in the jar. Guessing the other people's predictions is similar to guessing option value. When you 'buy' the jar to sell to someone else, you must guess what their predictions are (and thus, what they would be willing to pay).

### Actual amount

326 marbles



### Guesses of actual amounts

Highest guess  
395 marbles



### Guesses of others' predictions

Highest prediction of others' guess  
650 marbles



**ABOVE:** When people have to guess the value of something, the highest guess (the 'winning bid') generally exceeds its actual value. This is known as 'the winner's curse.' In our study, the highest guess for a jar with 326 marbles was 395.

When people are asked to guess the highest value that someone else submitted, the highest guess is greater still. In our study, the highest guess of others' submissions was 650 marbles – more than 50% higher than the greatest actual estimate (and almost double its actual value). Approximately half of the guesses to this question exceeded the highest actual guess.

# Price feedback loops: the fuel on the fire

**The real trouble occurs when investors start to rely on market price to understand what other investors think (e.g. what the most extreme price may be).**

These new beliefs then feed back into the market in the form of ever higher price offers, creating a link between current and future market prices: a 'feedback loop' where current market prices impound expectations of higher future market prices, leading both current market prices and future expectations to climb even higher, transforming mere mispricing into a *bubble*.

The self-reinforcing link between current and future market prices can occur in three broad ways, some of which impact both trained and untrained traders alike. First, as market price increases, it will exceed the maximum value that some investors expected, leading them to revise their expectations (and thus, their option values) upward. Market price will tend to rise to the value of highest expectations (Harrison and Kreps 1978). Second, untrained investors, who have not computed fundamental value for themselves, may rely on market price to inform their understanding of fundamental value – conflating an asset's fundamental value with its option value. These investors may buy and sell based on price trends, without distinguishing between market-based and fundamental-based sources of value. This can foster a type of magical thinking among untrained investors who do not understand the mechanics of the trends, leading them to believe that price trends will continue in the future because they have existed in the past. Third, if trained investors believe untrained investors have begun to flock to the market (even if they have not), the trained investors may begin updating their price expectations in a manner that resembles that of untrained investors, as they 'rationally' attempt to capitalize on untrained investors' false hopes. In all three of these examples, market prices can become self-reinforcing even in the absence of new information about fundamentals.

## EXHIBIT: THE 'BUBBLE'



Again, **it does not require investors to be confused for ‘investor confusion’ to ignite a bubble. So long as investors believe that at least some others are confused, price will tend to rise to the level of the greatest believed confusion.** In this way, the presence of unsophisticated ‘noise’ traders is not needed to fuel a bubble, but bubbles are frequently made worse by them.

## Can accounting contribute to market bubbles?

Although financial market bubbles rely on interactions between investors, institutions, and money, considerable debate has surrounded the possibility that *accounting* may contribute to the frequency and magnitude of market bubbles – a debate that reawakens in the fallout of each new crisis. There are two competing voices in the debate, arguing either that accounting is merely the messenger for the bubble, or on the other hand, that accounting is magnifying the processes that give rise to the bubble. While research on the matter is far from settled, we mention two channels where accounting could potentially ignite and inflame bubbles – through *complexity*, and through *feedback loops* that lead market information to become embedded in the reports that individuals use to value assets in the market.

Research suggests that *complexity* makes it easier to believe that some other investor has arrived at a different value. As discussed earlier, the belief that others hold different values is foundational to market bubble formation and growth. Complexities abound in accounting and are too numerous to list here. Annual reports filed with the SEC are often more than 100 pages in length, with only 4 or so pages dedicated to the core financial statements (e.g. balance sheet, income statement, etc.) and the remaining pages reflecting management discussion and lengthy footnotes. Anyone who has attempted to read these reports knows that they are filled with figurative rabbit holes, where technically complex and legalistic footnotes offer enigmatic details. Sometimes the footnotes also cross-reference one another, creating circularities within the reports themselves. The fact that even professional analysts covering the same companies frequently arrive on different valuations – despite having access to the same ‘public information’ – speaks to the complexities in interpreting accounting information.

One persisting challenge in the debate over whether and how to broaden recognition of intangible assets is their complexity.

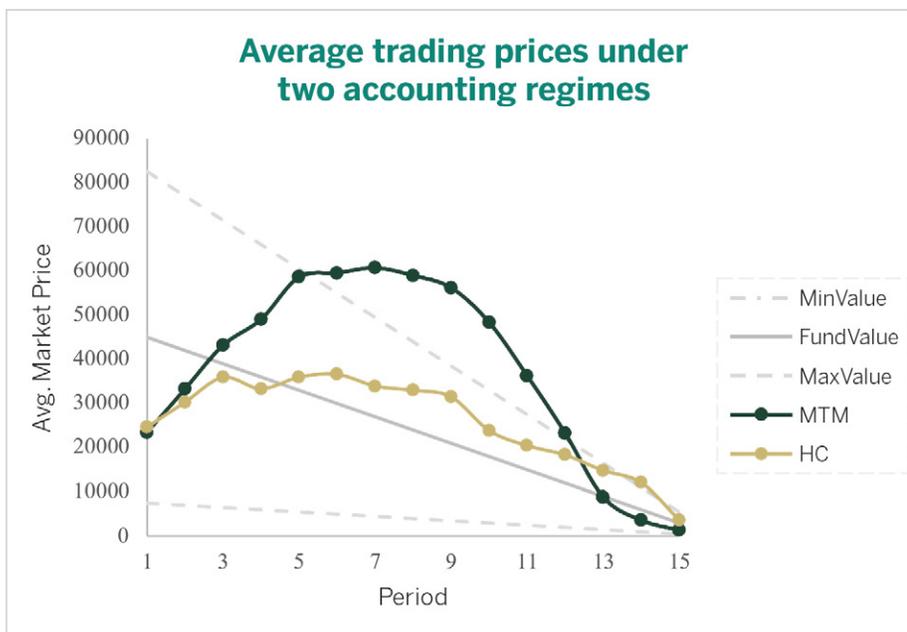
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**Secondly, accounting may introduce feedback loops that lead information *from* the market (e.g. market prices) to be fed into information *for* the market (e.g. individual company reports).** When this occurs, market swings can inflate company reports – making companies’ fundamentals seem stronger than they are, leading markets to swing further, and fundamentals to seem stronger still, and so on. For instance, some companies hold ‘mark-to-market’ assets that may be written up or down each period to their new market prices, with the changes feeding into the profit reported in financial statements. These feedback loops can be very difficult to identify and, even when known, can be even more challenging to unwind – fostering market bubbles on their own. Moreover, investors who can unwind these reporting circularities may nevertheless believe that others will be confused; these investors may price the errors anyway, based on the expectation that those who are fooled will be willing to pay a higher price. **Our research team has investigated the link between mark-to-market accounting and financial market bubbles, finding that market bubbles in simplified laboratory markets were both more frequent and of a greater magnitude when results were reported under mark-to-market accounting than when we used a non-market based system (historical cost).**

## EXHIBIT: DOES ACCOUNTING CONTRIBUTE TO MARKET BUBBLES?

**STUDY AT A GLANCE:** We organized several simple markets, similar to the ones described at the beginning of this article. Each market included 12 traders who traded a very simple stock (similar to a series of 15 coin tosses). All traders were trained on how to value the stock and how to use the market; all traders also knew that every other trader received exactly the same information. Half of the markets reported trader performance under mark-to-market accounting. The other half used historical cost accounting rules.

The expected value of the coin tosses (solid grey line) approximates fundamental value. The maximum and minimum possible values if every remaining coin toss was heads or tails (dashed grey lines) are the upper and lower conceivable limits. Average trading prices under the two accounting regimes are displayed in blue (mark-to-market) and orange (historical cost). Because everyone shares the same information, the only explanation for prices that deviate from fundamental value is mispricing.



**ABOVE:** Average market prices should follow fundamental value (solid grey line). Under mark-to-market accounting (blue) average market prices frequently bubble and crash, often exceeding the greatest possible payout (dashed grey line). Under historical cost accounting (orange), average market prices are high, but do not exceed possible payouts or exhibit steep price bubbles or crashes. In our study, we conclude that bubbles and crashes are more frequent and of higher magnitude under mark-to-market accounting.

# Is “X” in a bubble?

When we discuss this topic with friends, colleagues, and other audiences we inevitably face the very reasonable question, ‘is “X” in a bubble?’ where “X” is the market *du jour*. Recently, “X” has tended to be housing, cannabis stocks, or cryptocurrency prices. While there is no decisive test to confirm whether a market is or is not in a bubble, there are numerous indicators that suggest when caution may be due.

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## Smoke on the horizon: spotting a bubble

Two warning signs are a) the ratios of people buying assets to those using the assets, and b) the ratio of price changes to new information. Even when these ratios cannot be calculated precisely, casual experience can indicate when they may be shifting. For instance, in housing bubbles, two concerns are ‘flippers selling to flippers’ and/or ‘abandoned homes’, where homes are bought and sold without a homeowner moving in. Likewise, with cryptocurrencies, our experience is that many of our friends and family hold cryptocurrency assets such as bitcoin, but very few *use* them for buying/selling goods or wiring money to others. These indicators suggest that speculators are a significant presence in their respective markets, and that price may fall if speculators exit the market. Similarly, price sometimes tracks upward far quicker than information about its fundamentals would warrant. In housing bubbles, price increases faster than population growth or even forecasts of population growth; in the case of cannabis stocks, price cannot be justified by the number of customers and retail outlets that are known or planned.

The challenge with these cautionary measures lies in their imprecision. For instance, in the case of buyer-to-user ratios, we are not aware of any precise way to measure which buyers are also users; sometimes the distinction is itself blurred. Moreover, speculators can sometimes prop up demand for months or years (**‘will my liquidity outlast your irrationality?’**). And, even then, it can be difficult to anticipate by how much (if at all) price will settle after speculation runs its course, because it is possible for a market to be in a bubble state and still be undervalued – which may be the case with cryptocurrencies. Price-to-information ratios are also indirect and difficult to measure – **what is and is not ‘information’? And, is all information equal? It is difficult to distinguish rational disagreement from irrational mania.** The rapid rise of cannabis stock prices may be caused by ‘product loyalists’ who buy without regard to fundamentals; however, there may also be investors (rationally) pricing the possibility of other countries legalizing cannabis in the near future, pushing up demand.<sup>7</sup>

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<sup>7</sup> Short selling is sometimes discussed as an indicator of market bubbles but does not always materialize, for instance, because short selling depends on borrowing shareholdings that can become functionally frozen by share scarcity or by structure (e.g. housing markets). See Gromb and Vayanos (2010), DeLong et al. (1990) and Abreu and Brunnermeier (2002, 2003).

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Lastly, structural conditions may call for greater than normal caution. For instance, research suggests that microinvesting markets with thin trading depth are particularly prone to bubbles. These markets attract microinvestors who may be more likely to invest on sentiment (and less likely to have performed their due diligence). Additionally, larger traders may be able to move the market on their own, creating artificial upward trends to draw in unsuspecting inexperienced investors. Periods of 'cheap credit' where interest rates become very low and/or widely available also appear to precede many of the largest bubbles, as credit can magnify the decision processes underlying bubbles (see Lin Pfeiffer and Porter 2017; Rajan 2010; Mian and Sufi 2009). Given that interest rates have been held low in recent years, in response to the global pandemic, this signal of caution looms large.

## How to reduce the impact of bubbles

While we may not be able to prevent bubbles, there are actions that accountants, particularly CPAs, can take to reduce their frequency and magnitude, centering primarily around better information.

### 1. CUT COMPLEXITY

We should try to reduce complexity wherever possible. **We cannot communicate the full reality of a multi-billion-dollar enterprise – not in 5 pages, in 50 pages, or in 500 – but ever greater page space almost certainly contributes to the confusion that fuels speculative price bubbles.** We must weigh each new footnote or disclosure against the insight that it adds, because these footnotes come with foreseeable consequences in the form of confusion and self-fulfilling expectations for mispricing.

### 2. BE WARY OF MARKET VALUES

We must also exercise caution whenever incorporating market-based estimates into reports that invite circularities between assets and markets. **Market-based estimates come with an appealing logic that assumes away one of their greatest challenges: the problem of investors routing information *from* the market (e.g., prices) back *into* the market in the form of valuations.**

### 3. AVOID COGNITIVE TRAPS

Equally importantly, accountants must continue to exercise caution when consuming financial information and when advising others. **As bridges between our clients and financial information, we must help our clients to avoid the cognitive traps that draw us into bubbles, and to also recognize the warning signs of market bubbles before unintentionally joining.**

Outside of accounting, there are numerous creative solutions to the more structural mechanisms that underlie bubbles. Several provinces in Canada have succeeded in cooling over-heated housing markets with expatriate taxes. These taxes dampen the feeding frenzy by reducing the number of investors participating in a bubble; nevertheless, even if bubbles are made worse by an influx of international investors, they may arise and persist even without them. Requiring banks to increase their capital reserves during bull markets may also restrict the credit that fuels market bubbles, both by reducing the flood of borrowing that accompanies bull markets, and by helping to buffer banks against asset fire sales brought on by sudden downturns.

The collective experience of centuries of market bubbles suggests that they reflect our own economic psychology, attached to our humanity like a shadow.

**We may not know when or where the next price bubble will arise, but we can be confident that we will not need to travel far or wait long.**