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BUBBLES IN HISTORY

William Quinn (Queen's University Belfast)
John D. Turner (Queen's University Belfast)

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QUEEN'S UNIVERSITY CENTRE FOR ECONOMIC HISTORY
Queen's University Belfast
185 Stranmillis Road
Belfast BT9 5EE

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William Quinn*

John D. Turner#

Abstract: Bubbles have become ubiquitous. This ubiquity has stimulated research over the past three decades into bubbles in history. In this article, we provide a systematic overview of research into historical bubbles. Our analysis reveals that there is no coherent approach to the study of bubbles and much of the debate has unhelpfully focussed on the rationality/irrationality dichotomy. We then suggest a new framework for the study of historical bubbles, which helps us understand the causes of bubbles and their economic consequences. We conclude by suggesting ways in which business history can contribute to the study of historical bubbles.

Keywords: Bubbles, Business History, Speculation

JEL codes: G01, G10, G40, N10, N20, N80

* w.quinn@qub.ac.uk; # j.turner@qub.ac.uk

1. Introduction

Bubbles appear to be happening more frequently. The most recent notable example was the bitcoin or cryptocurrency bubble. Between August 2016 and December 2017, the price of one bitcoin rose from $555 to $19,783.[1] In the seven weeks following its peak, the value of one bitcoin fell by 65 per cent, and by December 2018, one year after its peak, it was valued at $3,332 – a fall of 83 per cent.[2] This bubble followed a bubble in the Chinese stock market in 2015, the housing bubble which preceded the Global Financial Crisis, and the dot-com bubble which burst in 2000.

This increased prevalence of bubbles has stimulated research by economists which attempts to understand why bubbles happen and how policymakers can deal with them. This research agenda has resulted in several competing and non-competing theories of why bubbles happen. It has also resulted in economists turning to various historical bubbles to test these theories. Although there are several extensive surveys of the theoretical and empirical literature on bubbles (Mayer, 2011; Brunnermeier & Oehmke, 2012; Scherbina & Schlusche, 2014), to date there have been no surveys of the extensive literature on historical bubbles.

In this article, we present the results of a systematic literature search of journal articles, working papers, and books on historical bubbles. This review article synthesises the existing research on historical bubbles and their causes. We find the traditional analytical lens used in a lot of research on historical bubbles is the rationality/irrationality dichotomy. In other words, most of the research on past bubble episodes takes a stance on whether they were driven by irrational investor behaviour or, alternatively, the pricing of the bubble asset was consistent with fundamentals, suggesting that investors were not acting in an irrational manner. We argue in this paper that this framework is not particularly helpful when it comes to analysing historical bubbles. As an alternative, we propose a different analytical lens to help scholars in their study

of bubble episodes. This lens, which we call the 'bubble triangle' has been developed after our in-depth review of the literature.

The insights provided by this new analytical lens will be illustrated by our examination of the societal costs and benefits of historical bubbles. Recent experience of the Global Financial Crisis suggests that bubbles can have major and long-lasting deleterious effects on economies. However, not all bubbles have had such negative consequences. Indeed, it has been suggested that some bubbles may actually be socially useful in that they bequeath something of value upon society that otherwise would not have occurred (Eatwell, 2004; Janeway, 2018). We use the literature on historical bubbles to understand the characteristics of bubbles which result in economic catastrophes versus those which are relatively benign or maybe even socially useful.

This review article is structured as follows. In the next section, we review existing theories about the causes of historical bubbles. Section three proposes a new framework for studying historical bubbles. Section four analyses the consequences of historical bubbles. Section five concludes the article by outlining how business historians can contribute to the development of society's understanding of bubbles.

2. Perspectives on the Causes of Historical Bubbles

Before we can survey past bubble episodes, we need to define what we mean by a 'bubble'. This is by no means straightforward: within academic economics and finance there has been considerable controversy over the use and meaning of the word 'bubble'. Garber (1990) disparages the term as a 'non-explanation', while O'Hara (2008) reports having been criticised for 'loose talk and unscientific thinking' after allowing the word to be used in a journal she had edited. Kindleberger (1996, p.16) proposes a simple definition of a bubble as 'an upward price movement that then implodes'. In practice, however, the term 'bubble' often also implies that

share prices became disconnected from their underlying intrinsic value. Donaldson and Kamstra (1996, p.336), for example, argue that 'there was *not* a bubble in 1920s [U.S.] stock prices' on the grounds that, although there was an upward price movement that subsequently imploded, prices were consistent throughout with their pricing model, which is based on potential dividends. However, the requirement for prices to have dissociated from intrinsic values makes it difficult to determine which episodes should be considered 'bubbles'. This is because the true intrinsic value of an asset is based on expectations, and is therefore unobservable. For the purposes of this article, we will therefore use Kindleberger's definition, which leaves open the possibility that fundamentals played a role in some of the bubbles described.

Our approach to finding studies on historical bubbles started with a search of the leading business and economic history journals. Given the recent interest of economists in bubbles, we also searched all the leading economics and finance periodicals for articles which focussed on or even mentioned historical bubbles. In addition, we also searched the NBER working paper series because many influential papers may not necessarily progress beyond the working paper stage. Furthermore, given the interest of central banks in bubbles, we also searched the working paper series of leading central banks, the International Monetary Fund and the Bank for International Settlements.

Because some bubbles have been focussed on real estate and housing, we also searched geography and urban planning journals. Because of the wider public fascination with bubbles, the final stage of our literature collection was to search the catalogue of the British Library to find books which have been published in the English language over the past two centuries and which have focussed on one or more historical bubbles

A non-exhaustive list of those episodes which have been identified as potential bubbles in this literature is shown in Table 1. Some of these are more well-known than others. The

Tulipmania, for instance, is one of the most famous bubbles, despite the fact that it concerned an infrequently traded and rare commodity and thus had minimal economic impact (Garber, 1989; Goldgar, 2007; Thompson, 2007). The Australian land boom, on the other hand, was the catalyst for one of history's most severe financial crises, but is not widely known outside of academic circles (Cannon, 1966; Hickson & Turner, 2002; Merrett, 1989, 1993).

<<INSERT TABLE 1 HERE>>

Financial bubbles have been studied by scholars from a wide range of academic backgrounds, and as a result, the literature shows substantial variation in methodology. Table 2 attempts to categorise these methodologies, giving examples of papers and books in which each has been used. Descriptive history is by far the oldest of these methodologies, whereas more quantitative techniques have grown in popularity since the cliometric revolution of the 1960s. The past decade has seen a trend towards using large-scale data analysis to examine bubbles as a general economic phenomena.

<<<INSERT TABLE 2 HERE>>>

Most descriptive histories of bubbles focus on explaining the causes of a specific episode, rather than on the causes of bubbles more generally. However, several influential works examine multiple bubbles with the aim of understanding their causes. The first major work to investigate multiple historical bubbles simultaneously was Charles Mackay's *Extraordinary Popular Delusions and the Madness of Crowds*, first published in 1841. Mackay argued that the South Sea bubble (1720), the Mississippi bubble (1720), and the Dutch Tulipmania (1636-7) resulted from a spontaneous outburst of madness at a societal level, comparable to fads in alchemy, fortune telling, and facial hair (Mackay, 1856). While much of the content within Mackay's narratives is now thought to be apocryphal, the general argument – that bubbles occur because of widespread irrational behaviour – has been advanced more rigorously by several modern economists (Galbraith, 1990; Kindleberger, 1996; Shiller, 2015).

Behavioural finance reveals some plausible ways in which a bubble could occur in financial markets. For example, a subset of investors could suffer from an overconfidence bias, whereby they overestimate the future performance of a financial asset, or they may have a representativeness bias, whereby they incorrectly extrapolate from a series of good news announcements and overreact (Barberis et al., 1998; Daniel et al., 1998). Herding effects could then induce other investors to follow this subset of investors (Lux, 1995). Continually rising prices might then induce mass euphoria, which is further propagated by sensationalist news media coverage (Shiller, 2015).

One of the most influential accounts of how behavioural factors could systematically lead to macroeconomic bubbles is that of Minsky (2008). Minsky argues that periods of stability breed overconfidence, which in turn leads to over-investment and the emergence of asset price bubbles. In other words, stability is destabilizing, and thus financial bubbles are inherent to capitalism. This theory is intuitively appealing, but it has limited explanatory power, offering no explanation for why bubbles occur in some assets and in some countries but not in others. Furthermore, if confidence cycles are of a relatively fixed duration, the frequency of bubbles should remain relatively constant across time. Table 1 suggests that this is not the case: the literature does not indicate that there were any major bubbles in the period between 1931 and 1982, whereas between 1982 and 2015, seven bubbles occurred, even when counting the housing bubbles in various countries during the 2000s as a single bubble. However, if the duration of confidence cycles can vary, the explanatory power of Minsky's theory is depleted further: in this case its only testable prediction is that bubbles exist, and will sometimes occur.

The existence of bubbles is itself disputed by another branch of literature, which argues that bubble-like patterns occur due to the rational response of investors to changes in the underlying fundamentals affecting the values of financial assets. In other words, bubbles do not provide evidence of market inefficiency. This school of thought has resulted in a body of

literature that attempts to justify the price of financial assets during historical 'bubbles', including the Tulipmania, South Sea Bubble, Mississippi Bubble, American railway manias of 1835 and 1843, U.S. stock market boom of the 1920s, Japanese land boom of the 1980s, and dot-com bubble of the late 1990s (Boone, 1989; Donaldson & Kamstra, 1996; Garber, 1990; Pástor & Veronesi, 2003, 2009). Making this case can be an uphill struggle, as it requires one to argue that the correct asset pricing model is one which would have recommended holding shares on the eve of history's most spectacular crashes. Accepting the conclusions of this branch of literature therefore often requires one to have a strong prior in favour of market efficiency. Many of the aforementioned studies have been contradicted by other research which argues that asset prices during historical episodes were, in fact, excessively high (Dale, 2004; DeLong & Magin, 2006; Rappoport & White, 1994; Stone & Ziemba, 1993;Velde, 2009; White, 1990).

Others have argued that bubbles can occur because investor rationality might not necessarily lead to an efficient market. For example, the ability of investors to profit by identifying overpriced stock could be restricted by constraints on their capacity to short sell (Ofek & Richardson, 2003; Schienkman & Xiong, 2003; Haruvy & Noussair, 2006). Such short selling would correct overvaluations by driving prices back to their fundamental value. The absence of formal legal restrictions on short selling during many historical bubbles might be thought to undermine this hypothesis. However, in addition to social and cultural disincentives to short sell, the limited regulation of early financial markets may have left short sellers vulnerable to market manipulators engineering a corner in short sold stocks (Allen et al., 2006; Quinn, 2019a).

Alternatively, informed investors may purchase an asset they know to be overpriced, as the boom may continue in the short term, and they could resell the asset to 'a greater fool' to make a capital gain in the future (Blanchard & Watson, 1982; O'Hara, 2008). This practice,

commonly referred to as ‘riding the bubble’, could be a rational response to uncertainty over the point at which a share price correction will occur (Abreu & Brunnermeier, 2002, 2003; Brunnermeier & Nagel, 2004; Xiong & Yu, 2011). There is direct evidence of investors ‘riding’ the South Sea and dot-com bubbles (Temin & Voth, 2004; Griffin et al., 2011). Dhar & Goetzmann (2005) find that over half of those interviewed about their trading activity during the dot-com bubble had bought a stock that they believed was overvalued in the expectation of future price increases. Survey data from the Japanese bubble of the 1980s has shown that a large number of institutional investors recommended buying stocks despite believing that, in the long run, the market would fall (Shiller et al., 1996).

Analysing the causes of historical bubbles in terms of rationality, however, poses several problems. First, categorising all participants in financial markets as either ‘rational arbitrageurs’ or ‘irrationally exuberant behavioural traders’, as Abreu & Brunnermeier (2003, p.179) have done, may be too great a simplification to properly explain the phenomenon. In real financial markets, prices are determined by the aggregate behaviour of investors with heterogeneous beliefs, risk preferences, and information. Second, what constitutes ‘rational’ investor behaviour has never been adequately defined (Opp, 2017). In the field of bubbles specifically, there is an ambiguous distinction between ‘irrational’ behaviour and the rational behaviour of investors with imperfect information or non-standard risk preferences. Individuals might also have non-financial reasons for investing in an asset during a bubble: wanting to support potentially world-changing technology firms during the 1920s, for example, or holding bitcoin for ideological reasons. To dismiss such behaviour as ‘irrational’ is reductive (and also somewhat disrespectful). However, if one broadens the definition of ‘rational’ behaviour to include misinformed and ideological investments, it becomes difficult to think of *any* investor behaviour that could reliably be called ‘irrational’. The framework thus loses all descriptive power.

The literature on historical bubbles illustrates the problems that can emerge due to ambiguity over the term 'rationality'. Neal (1990, p.75) argues that the Mississippi Bubble constituted a 'rational bubble', defined as 'a continuing rise in the price of an asset that is generated by market participants anticipating that rises in its price will continue to occur'. But this behaviour is similar to Kindleberger's (1996, pp.19-20) definition of 'pure speculation', which he characterises as a move 'away from normal, rational behaviour to what has been described as "manias" or "bubbles"'. In order to distinguish their hypothesis from that of Neal (1990), Dale et al. (2005, p.237) use a more limited definition of 'irrational' behaviour during the South Sea Bubble: the presence of 'totally unrealistic expectations about a company's future profitability'. But according to the definition of Campbell (2012), unrealistic expectations that are based on high current dividends might instead be an example of 'myopic rationality'. Given the lack of any consensus on the meaning of either 'rational' or 'irrational', we believe that the best way forward for future research on historical bubbles is for this framework to be discarded.

Another branch of the literature has investigated the link between bubbles and new technology. Perez (2009) argues that there have been five major technology bubble episodes in history: the Canal Mania of the 1790s, Railway Mania of the 1840s, the London-financed bubbles of the 1890s, the roaring twenties, and the dot-com bubble. Perez argues that these bubbles occur when excitement about a new technology, sometimes accompanied by early adopters earning extravagant returns, causes associated asset prices to rise above their fundamental value. Goldfarb and Kirsch (2019), using a sample of 88 technologies over 150 years, argue that technology leads to a bubble in the presence of four factors: uncertainty, compelling narratives about the new technology, an influx of novice investors, and the existence of 'pure play' technology firms to attract speculative investors. Pástor & Veronesi (2009) have suggested that technology bubbles can be explained by an *ex post* selection bias:

scholars studying historical bubbles know that a technological revolution took place, but investors living through the revolution were uncertain as to the eventual effect and wide-scale adoption of the new technologies. According to Pástor & Veronesi's model, changes in this underlying uncertainty explain the bubble-like patterns in new technology stocks.

This literature has provided abundant evidence that technology and bubbles are linked (Goldfarb & Kirsch, 2019). In some bubbles, such as the dot-com bubble, the possible connection with new technology is obvious, but research has suggested that it also played a role in other famous episodes: Nicholas (2007) shows that the increasing value of new technology was an important driver of the 1920s stock market boom, while Frehen et al. (2013) highlight the role of innovation in the insurance industry during the bubbles of 1720. Evidence on the mechanism by which technology leads to a bubble has been mixed. Pástor & Veronesi (2009) support their hypothesis with evidence from the dot-com bubble and American railway manias, and Frehen et al. (2013) suggest that similar dynamics may explain the behaviour of insurance stocks during the South Sea Bubble. However, Quinn (2019b) shows that these dynamics cannot explain the British Bicycle Mania of the 1890s, concluding that Perez (2009) provides a more widely applicable model for explaining the link between technology and bubbles.

Excessive money and credit have also been blamed for creating historical bubbles. It has often been suggested that low interest rates limit the return on traditional assets, inducing investors to buy speculative assets to 'reach for yield' (Acharya & Naqvi, 2019; Becker & Ivashina, 2015). Hayek (1935) argues that stock-market bubbles are the result of artificially cheap credit, which attracts investment into unsustainable projects. Once interest rates start to rise and credit stops flowing, these unsustainable projects are liquidated, resulting in a stock-market crash. Perez (2009) advocates distinguishing between 'major technology bubbles' and 'excess liquidity bubbles', with the latter generally more economically destructive than the

former. Others highlight the role of financial institutions: Allen & Gale (1999, 2000) argue that the banking system can encourage money to flow into risky bubble assets by creating a situation in which banks are lending other people's money and borrowers are borrowing other people's money. As a result, neither banks nor borrowers bear the full downside risk of their investment decisions.

There is circumstantial evidence for a link between easy monetary conditions and bubbles. Recent bubbles have typically been accompanied by relatively low interest rates (Noguchi, 1994a; Jordá et al., 2015b). The booms of the 1890s in brewery, mining, and bicycle shares also occurred when interest rates were at a then-record low (Acheson et al., 2016; Quinn, 2019a; Van Helten, 1990). A surprising exception is the 1920s U.S. stock market bubble, almost all of which occurred when the Federal Reserve's discount rate was above its historical average (White, 1990). Bubbles have also been shown to be systematically linked to credit expansions. Jordá et al. (2015a) show that, over the past 140 years, housing bubbles have been significantly more likely to occur when mortgage credit is cheap and widely available. This in turn increased the risk of a financial crisis. However, the British Bicycle Mania and dot-com bubble show that bubbles need not necessarily be fuelled by credit.

The links between money, credit, and bubbles imply that political economy is crucial to understanding bubbles, since political institutions exercise considerable control over the levels of money and credit in an economy. However, very few theoretical models of bubbles incorporate political factors.[3] This is surprising because many case studies of bubbles focus extensively on the role of politics. Dickson (1967), in what is still the dominant narrative of the South Sea Bubble, describes how the bubble was created by Parliament so that the promise of capital gains would induce holders of government debt to subscribe to an unfavourable conversion. The Mississippi Bubble, likewise, was inherently political, engineered by John Law in an unsuccessful effort to reduce the French government's debt burden (Murphy, 1997;

Velde, 2003, 2006, 2009). Noguchi (1994a, 1994b) has argued that the Japanese land bubble of the 1980s was linked to easy monetary policy, distortions in the tax system, and leasing laws; Murphy (1996, p.154) quotes a senior Bank of Japan official as stating that the bubble was deliberately engineered by the government to provide Japanese business with a 'safety net'.

Finally, there has been some research into the role played by the news media in bubbles. Case & Shiller (2003, p.332) argue that bubbles are driven by simple, viral stories about the asset experiencing the bubble, noting that regional housing bubbles are often accompanied by local news stories about houses being sold well above the asking price. The *New York Times*, albeit only half-seriously, made the subtext of these stories explicit during the cryptocurrency bubble, running a story entitled "Everyone is Getting Hilariously Rich Except You". But attempts to test the impact of the news media during historical bubbles have come to mixed conclusions on whether they reinforce market sentiment or merely reflect it (Bhattacharya et al.,2009; Campbell et al., 2012; Soo, 2018).

3. A New Framework for Understanding Historical Bubbles

History offers a useful corrective to the tendency of economists and other social scientists to search for generalizable theories by helping us to contextualise the settings in which bubbles occur. The role of business historians is to attempt to bring these two approaches together and develop more insightful and nuanced explanations for the phenomena we observe in the past. In the case of historical bubbles, we advocate a new framework which helps us understand why bubbles happen and why their economic consequences vary from the beneficial to the benign to the detrimental.

Our new framework is based on a metaphor from chemistry: the fire triangle. Given sufficient levels of oxygen, fuel and heat, a fire can be started by a simple spark. Once the fire has begun, it can be extinguished by the removal of any these components. In the bubble

triangle, we have three sides: marketability, money and credit, and speculation (Quinn and Turner, 2020).

The oxygen for the bubble is marketability: the ease with which an asset can be freely bought and sold. One of the first dimensions of marketability is legality. Banning the trading of an asset usually makes buying and selling it more difficult. Historical bubbles have often been preceded by the legalisation of certain types of financial assets, such as tradable shares in companies. Another dimension is divisibility. Public companies, for example, are more marketable than houses, because it is possible to trade small proportions of the company by buying and selling its stock. A third dimension of marketability is the ease of finding a buyer or seller. Historical bubbles have often been characterised by increased participation, thus expanding the potential pool of buyers and sellers (Quinn and Turner, 2020). The final dimension of marketability is how easily the asset can be transported. Like oxygen, marketability is always present to some extent, and is, indeed, essential for an economy to function.

The fuel in the bubble triangle is money and credit. A bubble can form only when the public has sufficient funds to invest in the asset. Low interest rates and loose credit conditions have stimulated the growth of historical bubbles in two ways. First, when credit conditions are loose, a greater quantity of bubble assets can be purchased on credit. This increases demand for riskier assets because investors do not bear the full downside risk of assets bought with borrowed money (Allen, 2001; Allen & Gale, 1999, 2000, 2005). The ability of banks to curb switching by borrowers from safe to risky assets is limited because such risk shifting cannot be observed. Furthermore, the greater the expansion of bank lending, the greater will be the amount of funds available to invest in the supply of bubble assets, increasing prices further. When investors start selling their bubble assets in order to repay loans, the price of these assets is likely to collapse. The fuel for several historical bubbles in Table 1 – namely the Mississippi

bubble of 1720, the Australian land boom of the 1890s, the Japanese bubble of the 1980s, and the subprime housing bubble of the 2000s – came from deregulated or unregulated banking systems. For others, the fuel came from margin financing (e.g., the roaring twenties or China's bubble of 2015) or an archaic form of margin financing whereby only a part of a share had to be paid up to begin with (e.g., the bubbles of 1720, 1825 and the Railway Mania of the 1840s).

Second, low interest rates on traditionally safe assets, such as government debt or bank deposits, can push investors to reach or search for yield by investing in risky assets instead. As a result, funds flow into riskier assets, where a bubble is much more likely to form. Low yields played a role in several historical bubbles and, more recently, the dotcom bubble (Quinn & Turner, 2020).

The heat in our bubble triangle is speculation. Speculation is the purchase (or sale) of an asset with a view to selling (or repurchasing) the asset at a later date with the sole motivation of creating a capital gain (Kaldor, 1939). This investment strategy is always present to an extent, but during historical bubbles, large numbers of amateurs become speculators, many of whom trade purely on momentum. Just as a fire produces its own heat once it starts, speculative investment is self-perpetuating. Early speculators make large profits, attracting more speculative money, which in turn results in further price increases and higher returns to speculators. Once a bubble is under way, professional speculators may 'ride the bubble' (Blanchard and Watson, 1982; O'Hara, 2008; Abreu and Brunnermeier, 2002, 2003). Speculation in historical bubbles has been much more widespread when investors have limited exposure to downside risk. This may be the case when defaulting on debts incurs few costs, when institutional investors are faced with poorly designed incentive structures or when bank owners have limited liability (Turner, 2014). In these circumstances, buying a risky asset in the hope of short-term gains is much more appealing to investors.

Investors can also speculate in the opposite direction by short selling the asset, which could theoretically prevent a bubble from forming. During historical bubbles, however, short selling has often been very risky because of its potential to ruin an investor if an asset price continues to rise. Short sellers have also been subject to legal or regulatory restrictions and social opprobrium, while bubbles which occurred in less regulated markets exposed investors to corners (Quinn, 2019a).

The three sides of the bubble triangle – marketability, money and credit, and speculation – are necessary but not sufficient conditions for a bubble. All three can be present and no bubbles emerge. Just as fires require a spark to start, so bubbles also require a spark. In this framework, the spark comes from technological innovation or government policy.

Technological innovation can spark a bubble by generating abnormal profits at firms that use the new technology, leading to large capital gains in their shares. These capital gains then attract the attention of momentum traders. At this stage, many new-technology companies go public to take advantage of the prevailing high valuations. This is what happened, for example, during the British bicycle mania, the roaring twenties in the U.S., and during the dotcom era. While valuations may appear unreasonably high to experienced investors, they often persist for at least two reasons. First, the technology is new, and its economic impact is highly uncertain, which means that there is little information with which to value shares. Second, excitement surrounding technology leads to high levels of media attention, drawing in more and more investors. This is often accompanied by the emergence of a 'new era' narrative, which justifies the very high prices (Perez, 2009).

Bubbles can also be sparked by government policies that cause asset prices to rise (Hickson & Thompson, 2006). Usually, but not always, the rise in asset prices has been engineered deliberately in the pursuit of a particular goal. For some bubbles, this goal has been the enrichment of a politically important group, or of politicians themselves. For others the

bubble has been used as part of an attempt to reshape society in a way that the government deems desirable. For example, the first major financial bubbles were engineered by governments in Paris and London as a creative way to reduce the public debt. Several housing bubbles have emerged as a by-product of government policies to increase home ownership.

As well as creating the spark through their policy decisions, governments can pull other policy levers which affect one or more of the sides of the bubble triangle, making it easier to engineer a bubble. For example, governments can lower interest rates or increase the money supply. They can deregulate the financial system, enabling banks to lend more money on less restrictive terms. An extension of credit can allow more investors to buy into the bubble on leverage, encouraging them to engage in more speculation. Financial deregulation may also make it easier to buy and sell the assets involved in the bubble, increasing their marketability.

The bubble triangle, as well as explaining why bubbles begin, can help us understand why they end. First, they can simply run out of fuel – increases in the market interest rate or central bank tightening, for example, can choke off the credit that was being used to invest in bubble assets. This makes borrowing to invest in an asset more difficult for speculators, which can in turn trigger a selloff. The tightening of credit can also make it impossible for those who invested in the bubble with borrowed money to extend the duration of their loans, forcing them to sell the asset. Second, the number of speculators is finite, and can eventually reach an upper limit. Speculators may be spooked and exit the market when new information arrives which changes their expectations about future prices. The effect of momentum trading is reversed: investors sell the asset because its price is falling, and the belief that prices will continue to fall becomes self-fulfilling.

4. The Consequences of Historical Bubbles

If bubbles were simply financial phenomena with no impact on output, unemployment, or consumption, then they would simply be infrequent curiosities of financial markets and there would be little merit in studying them. However, historical bubbles have had at least two major negative economic consequences.

First, the bursting of a bubble can result in a banking crisis. This is because the collapse of asset prices can reduce the value of collateral, resulting in a large number of defaults and bankruptcies (Kindleberger, 1996). A banking crisis, in turn, can cause major and long-lasting damage to an economy, either because the money supply contracts or because banks stop lending to businesses and investment dries up (Bernanke, 1983; Dell'Ariccia et al., 2008; Friedman and Schwartz, 2008). Just under half of the bubbles in Table 1 were followed by banking crises, and in most cases, these can be directly attributed to the bursting of the bubble.

The Australian land boom illustrates how a bubble can lead to a banking crisis, which in turn ushers in a deep and long-lasting economic recession. The bursting of the Australian land boom resulted in the failure and subsequent restructuring of just over half of the Australian banking system (Peel, 1893; Merrett, 1989, 1993). Banks which were more exposed to the land boom were the ones that failed (Hickson & Turner, 2002). The reconstruction and recapitalisation of the banking system during the 1890s resulted in a continuous contraction of credit until the early 1900s. As a result, very little investment occurred for over a decade and Australia experienced the deepest and longest recession in its history (Butlin, 1962, 1964; Fisher and Kent, 1999). The human cost of this was severe with many malnourished children, families broken up, and women forced to turn to prostitution (Cannon, 1966).

Second, bubbles can have long-lasting negative effects on economies by influencing attitudes to finance or post-bubble regulation (Dagher, 2018). Negative societal attitudes to finance, or counter-productive financial regulation, could potentially slow down financial

innovation, increase the cost of credit for businesses, or even stymie new business creation. Because finance matters for economic growth and the financing of innovation and entrepreneurship, the unnecessary hindrance of financial markets has a large economic cost (Beck and Levine, 2004).

One example of post-bubble hostility to finance was after the Mississippi bubble of 1720. Beneficial financial reforms, such as paper money, were continually rejected for the rest of the century because of their role in the Mississippi bubble and its calamitous aftermath. As a result, French financial institutions and markets remained stagnant and inefficient for over a century (Murphy, 2005). There was also hostility to the joint-stock company form after the South Sea bubble. Under pressure from the South Sea Company, the UK passed the Bubble Act in 1720, which forbade the formation of any joint-stock companies in the absence of Parliamentary approval. The importance of this Act may have been overstated in the past – joint-stock companies were already illegal under the common law – but in any case, very few companies formed after the South Sea scheme collapsed (Harris, 1994; Turner, 2018).

While bubbles are usually perceived of as episodes which wreak havoc and are extremely destructive, some historical bubbles may have had some positive consequences. Eatwell (2004) has suggested that bubbles can be socially useful, in that although they may not be efficient or optimal, they sometimes bequeath something beneficial upon society. There are at least three ways in which bubbles could be construed as being useful.

First, many historical bubbles have been associated with transformative technologies. The Railway Mania resulted in the UK having a huge national rail network (Campbell & Turner, 2015). The British bicycle mania made low-cost transport possible for hundreds of thousands of people and played a role in women's liberation (Quinn & Turner, 2020). The roaring twenties witnessed the spread of electrification and the development of mass-produced automobiles, airplanes and radio (White, 1990; Nicholas, 2007). The dot-com bubble gave us

a network of fibre optic cables (Eatwell, 2004). All of these technologies have ultimately transformed economies, making them more productive and stimulating high economic growth (Gordon, 2016). Bubbles provided these new technologies with much more capital than would have been available otherwise, and without bubbles, technological transformations may not have occurred to the same degree or at the same speed.

Second, the new technology developed by bubble companies can help stimulate future innovation in technology, and bubble companies may themselves use the technology developed during the bubble to move into a different industry. The technology developed during the Bicycle Mania helped stimulate innovation in motorcycles and cars: Dunlop, Rover, and Rudge-Whitworth all originated as cycle firms that went public during the mania. Technology bubbles may also encourage more people to become entrepreneurs, which ultimately feeds into future economic growth (Olivier, 2004).

Third, the financial architecture and innovations which facilitated the bubble may remain intact despite the bursting of the bubble, and this might ultimately prove useful to future entrepreneurs (Eatwell, 2004). For example, the Railway Mania established the limited liability company as the main way for entrepreneurs to raise finance for large-scale capital projects. Similarly, the dot-com bubble may have left a financial legacy for future entrepreneurs by facilitating a major increase in the capacity of the US venture capital industry. Venture capital is now financing the digital platform, AI, biotech, and nanotechnology industries.

Can the 'bubble triangle' framework outlined in the previous section help us understand why some bubbles have major negative effects whereas others are more benign or even useful? Figure 1 looks at historical bubbles along two dimensions – the spark for the bubble, technological or political, and the fuel for the bubble, whether leverage was provided by banks or capital markets. Three of our historical bubbles had a political spark and a bubble fuelled by bank leverage. Notably, each of these bubbles had a devastating and prolonged effect

on the economy and wider society, which suggests that the combination of a political spark and bank leverage creates destructive bubbles. The two bubbles in the bottom left box, where the spark for the bubble was technological and there was no bank or capital-market leverage, had few negative effects. Indeed, both of these bubbles were useful in that they generated a new transformative technology which benefitted and even liberated society. In the four historical bubbles in the middle two boxes, the extent of the economic damage depended on how exposed the financial system was to the capital market leverage generated during the bubble. There was a severe banking crisis after the first emerging market bubble and the Roaring twenties bubble. In both cases, stock investors were highly leveraged, but this was only a contributory factor, and not the primary cause, of the subsequent banking crisis.

<<INSERT FIGURE 1 HERE>>

5. Conclusion

This article has suggested a new framework for examining historical bubbles as an alternative to the traditional rational-versus-irrational approach to bubbles. Indeed, we go further by suggesting that the lack of consensus on the meaning of rationality implies that this existing framework should be discarded by scholars. Our new analytical lens, which we name the 'bubble triangle', has three elements that are necessary but not sufficient conditions for a bubble – speculation, money and credit and asset marketability. The sparks which set the bubble alight come either from technological innovation or changes in government policy.

How can business historians contribute to the development of society's understanding of bubbles? First, they have a role in discovering and explaining lesser known bubble episodes, particularly those that have occurred outside of the major industrial nations. Business historians of Africa, Asia and Latin America can perhaps discover or reveal to a wider audience previously unknown bubble episodes. Second, business historians can bridge the gap between

the highly quantitative studies on bubbles typically published in finance or economics journals and the studies that fully explore the historical, technological and political context in which each individual bubble occurred. This need for context will prevent social scientists of all descriptions from falling into the trap of advancing a monocausal explanation for bubbles. However, bridging this gap will require business historians to be multidisciplinary in their approach and use more than an historical lens in their investigations. In addition, we need to engage more with the discipline and methodology of economics if we are to communicate with the 'queen' of the social sciences.

Third, business historians can help explain the relationship between financial bubbles and fraud. Robb (1992, p.31) notes that periods in which bubbles occurred in 18th and 19th century Britain coincided with a spike in the level of white collar crime, and several authors have linked the dot-com bubble to the fraudulent accounting practices that culminated in the collapse of Enron (Brennan, 2004, Lowenstein, 2004). In particular, Ponzi schemes would appear to have much in common with bubbles in terms of investor behaviour – Charles Ponzi's scheme emerged from the bubble in Floridian land in the 1920s, and was arguably made possible by the abundant money, debt, and speculation that led to the bubble itself (Zuckoff, 2005). However, the literature has up to now has rarely examined these links, typically treating fraudulent schemes and bubbles as two distinct phenomena.

Finally, business historians have an important role in explaining the economic, technological, and – perhaps most importantly – institutional effects of bubbles. The most profound long-term impact of a bubble has often lay in how it reshaped political, legal, financial, and corporate institutions, and this is an aspect of bubbles which business historians are uniquely well placed to investigate.

Table 1. Historical episodes identified as bubbles

Bubble	Location	Years	Asset	Post-bubble financial crisis	Key Literature
Tulipmania	Netherlands	1636-37	Tulip bulbs and tulip bulb contracts	No	Goldgar (2007), Garber (1989, 1990, 2001), Posthumus (1929), Thompson (2007)
Mississippi Bubble	France	1719-20	Mississippi Company stocks	Yes	Davis (1887), Murphy (1997), Neal (1990, 2012), Quinn & Turner (2020), Velde (2003, 2006, 2009)
South Sea Bubble	UK	1719-20	Company stocks (including stocks of the South Sea Company)	No	Anderson (1801), Carswell (1960), Dale (2004), Dale et al. (2005), Dickson (1967), Frehen et al. (2013), Garber (1990, 2001), Hoppit (2002), Hutcheson (1720), Kleer (2012, 2015), Paul (2011), Shea (2007), Temin & Voth (2004)
Canal Mania	UK	1793	Canal stocks	No	Kindleberger (1996), Ward (1974)
First emerging market bubble	UK	1824-26	Company and mining stocks	Yes	Chancellor (1999), Dawson (1990), Fenn (1969), Quinn & Turner (2020), Rippy (1947), Taylor (2006)
Railway Mania	UK	1844-46	Railway stocks	No	Bryer (1991); Campbell (2012, 2013, 2014), Campbell & Turner (2012, 2015), Lewin (1936), McCartney & Arnold (2003), Odlyzko (2010), Smith (1848)
Australian Land Boom	Australia	1886-93	Company stocks and real estate	Yes	Butlin (1964), Cannon (1966), Davison (1978), Hickson & Turner (2002), Merrett (1989), Quinn & Turner (2020).
Bicycle & Beer Mania	UK	1895-98	Stocks of bicycle and brewing companies	No	Acheson et al. (2016), Amini & Toms (2018), Grew (1921), Harrison (1969), Quinn (2019a, 2019b)
Roaring Twenties	USA	1920-31	Stocks of new technology companies	Yes	Donaldson & Kamstra (1996), Eichengreen & Mitchener (2003), Galbraith (2009), Klein (2001), Nicholas (2007), Rappoport & White (1994), White (1990, 2009), Wigmore (1985)
Scandinavian Housing Bubble	Sweden, Norway, and Finland	1982-92	Real estate	Yes	Englund (1999), Moe et al. (2004), Nyberg (1994)
The Taiwan Bubble	Taiwan	1982-92	Company stocks	No	Champion (1998)
Japanese Bubble	Japan	1985-92	Company stocks and real estate	Yes	Dehesh & Pugh (1999), Murphy (1996), Noguchi (1994a, 1994b), Okina et al. (2001), Oizumi (1994), Shiller et al. (1996), Stone & Ziemba (1993), Wood (1992)
Dotcom Bubble	USA	1995-2001	New technology stocks	No	Brennan (2004), Cassidy (2002), Cellan-Jones (2001), DeLong and Magin (2006), Griffin et al. (2011), Ljungbist & Wilhelm (2003), Lowenstein (2004), Ofek & Richardson (2003), Pástor & Veronesi (2006, 2009)
Global Housing Bubble	USA, UK, Ireland, Spain	2001-2008	Real estate	Yes	Gjerstad & Smith (2009, 2014); Honohan (2009); Kelly (2009), Mayer (2011), Mian & Sufi (2009, 2014), McCarthy et al. (2015), Müller (2011), Norris & Coates (2014), Quinn & Turner (2020); Turner (2014)
The Chinese Bubbles	China	2007, 2015	Company stocks	No	Li (2015), Lu & Lu (2017), Quinn & Turner (2020), Smith (2016), Yao & Luo (2009)

Table 2. Methodologies used to study financial bubbles.

Methodology	Explanation	Examples from Literature
Descriptive history	Constructing narratives of one or more financial bubbles based on qualitative sources and stylized facts.	Anderson (1801), Cassidy (2002), Chancellor (1999), Dickson (1967), Galbraith (2009), Kindleberger (1996), Lewin (1936), Mackay (1856)
Formal economic modelling	Determining the circumstances in which bubbles can or cannot occur by applying deductive reasoning to a set of assumptions.	Abreu and Brunnermeier (2002), Blanchard and Watson (1982), Brunnermeier and Oehmke (2012), Scheinkman and Xiong (2003), Tirole (1982)
Quantitative history	Using statistical methods on historical data to test the propositions of descriptive historians and economic models on specific episodes.	Campbell (2012), Donaldson and Kamstra (1996), Frehen et al. (2013), Neal (1990), Quinn (2019b), Velde (2009).
Cyclical explanations	Identifying patterns in the progression of bubbles through informal observation of past episodes.	Kindleberger (1996), Minsky (2008), Rodrigue (2020)
Large-scale data analysis	Using a wide range of financial data over a long period of time to formally test theories about bubbles.	Goetzmann (2015), Greenwood et al. (2017), Jordá et al. (2015a, 2015b)

Political spark		First emerging market bubble South Sea bubble Railway mania Chinese bubbles	Mississippi bubble Australian land boom Japanese bubble Global housing bubble
Technological spark	Bicycle mania Dotcom bubble	Roaring twenties	
	Low capital-market leverage	High capital-market leverage	Bank leverage

Figure 1. *Bubble Sparks and Leverage*

Source: Quinn & Turner (2020, p.213).

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[1] https://www.coindesk.com/price/bitcoin

[2] https://www.coinbase.com. Other cryptocurrencies fared even worse. Invictus Capital's CRYPTO20 index, which tracked the value of the 20 largest cryptocurrencies, fell by over 93 per cent https://crypto20.com.

[3] An exception is Hickson & Thompson (2006), who argue that governments engineer bubbles for one of two reasons: to convert unsustainably high levels of government debt, or to redistribute wealth away from the middle classes when a change in circumstances makes doing so politically expedient.