A Historical Investigation of the Catalysts and Drivers of Asset Price Bubbles

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by

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Abstract:

This paper evaluates the catalysts and drivers of speculative bubbles from a historical perspective. **This analysis aims to identify the indicators of speculative bubbles that are commonly present across historical and modern economic bubbles, and to evaluate whether these indicators are present in potential bubble-forming economies.** The first section focuses on the theoretical framework of bubble formation under the following dominating theories: self-fulfilling expectation theory, Greater Fool Theory and the Positive Feedback Approach. The first section is followed by a detailed narration of historical bubbles which highlight the factors that contribute to the creation, propagation and bursting of asset bubbles. Next, these historical cases are compared in order to determine the key catalysts and drivers of bubble formation. Based on the qualitative analysis of bubble formation, the relationship between present price change, fundamentals and past price behavior is tested using a pooled regression technique. Concluding remarks will discuss the overall implications of this analysis and provide details of potential future research.
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Section I: Introduction

In a rational market, the occurrence of speculative asset price bubbles would be non-existent. Perfectly competitive markets with full information about the future would be perfectly efficient. Furthermore, market prices would be indicative of the fundamental value of assets and the level of risk associated with them. Fundamental value is a measure of the intrinsic economic value of an asset, which can be measured by indicators such as the asset’s future dividend stream adjusted for inflation or price-to-earnings ratios (P/E ratio), along with a premium for the level of risk (Flood & Garber, 1980; Li & Chand, 2015; Tirole, 1982). Due to the presence of these efficient market conditions, the economy would maintain a stabilized market which would not propagate the chance of speculative behavior. However, in reality, market participants do not have access to perfect information. As a result, the level of risk, future prices and inflation are unknown factors. Under these conditions, investors will base their valuation of assets on their expectations. The tendency of investors to base investment decisions on expectations and their potential to stray from the fundamental value of an asset can give rise to speculative behavior and act as a catalyst in the development of a speculative asset bubble (Siegel, 2003).

This paper focuses its attention on the study of historical and modern speculative bubbles. Characteristically, bubbles form due to the trend-chasing behavior of market participants. That is, during the development of an irrational bubble, investors make investment decisions without considering all existing fundamental information (Siegel, 2003). Traditionally, economists propose that the potential factors that contribute to the development of irrational bubbles are speculation, market manipulation and human
psychology (Chang, Newman, Walters and Wills, 2016; Mackay, 1996). However, over the past few decades, asset price bubbles have facilitated destructive banking crises, which have shifted the focus of the potential factors that develop irrational bubbles. In the current anatomy of irrational bubbles, it is argued that lax regulations, risky financial innovations, excessive risk-taking by financial institutions and loose monetary policy are the leading catalysts in the development of speculative asset bubbles (Roy & Kemme, 2012). The emergence of modern speculative asset bubbles has fueled a debate amongst economists concerning the primary factors that contribute to the development of speculative bubbles.

Although extensive research has been conducted on the development of historical bubbles, the rise of modern economic bubbles in emerging economies has facilitated the need to reevaluate the common factors that lead to the development of speculative bubbles. **Thus, this paper aims to identify the catalysts of bubbles that are commonly present across historical and modern economic bubbles and to evaluate whether these catalysts are present in potential bubble-forming markets.** Section II details the theoretical development of speculative bubbles according to the dominating theories of economics: self-fulfilling expectation theory, Greater Fool Theory, and the Positive Feedback Approach. Sections III and IV provide a narration of the creation, propagation and bursting of famous early bubbles and modern bubbles. Based on the observed catalysts of speculative bubbles in sections III and IV, section V determines the key catalysts and drivers of bubble formation. Section VI qualitatively examines the presence of the outlined catalysts and drivers in the potential bubble-forming markets of emerging economies. Section VII tests for the existence of speculative asset price bubbles in the
housing market of the United States from 1977-2016 by evaluating the relationship between present price change, fundamental indicators and past price change. Lastly, section VIII provides concluding remarks regarding the overall discoveries of this research and suggests possibilities for future research.
Section II: The Theory of Bubbles

This section focuses on developing the theoretical framework of bubble formation in the economy. First, we will define the theoretical relationship between economic fundamentals and the development of speculative price bubbles based on the economic theory of self-fulfilling expectations. Second, we will discuss the essential components of the Greater Fool Theory and how it contributes to the development of a plausible speculative asset price bubble. Third, by focusing on the field of behavioral finance, this discussion will highlight how the positive feedback approach and past price behavior promote the development of speculative bubbles. The main objective of this section is to provide a presentation of the dominating theories behind the propagation of speculative price bubbles.

2.1: Asset Price Fundamentals

In the study of speculative asset price bubbles, the economic theory of self-fulfilling expectations is considered a dominating theory behind the creation of bubbles (Tirole, 1982). Based on this theory, the valuation of an asset is not only determined by a market participant’s valuation of an asset based on economic fundamentals, but also is reflective of the market participant’s speculative behavior. The difference between the market price and the economic fundamentals, which is the valuation of an asset based on speculative behavior, is called a “bubble” (Flood & Garber, 1980; Li & Chand, 2015; Tirole, 1982). The speculative behavior of multiple market participants gives rise to the propagation of bubbles. While the existence of speculative price bubbles is controversial, some of the most notable examples of economic bubbles are the Dutch Tulip Mania, the
South-Sea Bubble, the Railway Mania, the Baburu Keiki of Japan in the late 1980s, the Dotcom Bubble in the late 1990s and the U.S. Housing Bubble.

The valuation of an asset that is solely based on economic fundamentals needs to be determined in order to establish the value of the asset that exceeds fundamentals. When studying the existence of speculative bubbles, the difficulty that arises in determining the valuation of economic fundamentals is what causes debate over the existence of bubbles. In part, the existence of bubbles is controversial because the valuation of fundamentals is uncertain (Flood & Garber, 1980). One can define economic fundamentals as the discounted future cash flows from an asset based on the rational expectation of that asset’s performance. The fundamental value of an asset can be calculated by discounting the future earnings stream of the asset along with the future ending value (Li & Chand, 2015; Tirole, 1982).

If \( E_0 \) is declared but not received yet, and \( r \) is constant, the calculation of fundamentals can be represented in the following manner:

\[
NPV(E) = E_0 + \frac{E_1}{(1 + r)} + \frac{E_2}{(1 + r)^2} + \ldots + \frac{E_\infty}{(1 + r)^\infty} = \sum_{i=0}^{\infty} \frac{E_i}{(1 + r)^i}
\]

In the formula above, NPV refers to net present value, which is an investment measure that compares the present value of future discounted earnings stream to the amount invested today. The variable “\( E_i \)” is the expected cash inflow of the defined period. The discount rate is defined by the variable “\( r \)”, and “\( r \)” is constant. The variable “\( i \)” is the time period for which the NPV is being calculated for. However, if we assume that the dividend growth rate is constant, then the following can be stated:

\[
E_1 = E_0(1 + g), \ E_2 = E_1(1 + g), \ldots \ E_i = E_0(1 + g)^i
\]

So,
\[ NPV(E) = \sum_{i=0}^{\infty} E_0 x^i \]

Where,

\[ x = \frac{1 + g}{1 + r} \]

In the equation above, “g” denotes the dividend growth rate of the asset. As stated before, the price of an asset should represent the value of the asset based on economic fundamentals. Therefore, if NPV captures the discounted future earnings stream of an asset then, the following can be written:

\[ P_0 = NPV(E) \]
\[ P_0 = E_0 \sum x^i \]

The previous equation uses “P₀” to represent the current price of the asset. If the previous equation is represented using an infinite series, then the following results:

If \( g < r \), then \( x < 1 \) and the following is true,

\[ 1 + x + x^2 + x^3 + \ldots x^{\infty} = \frac{1}{1 - x} \]

If \( \frac{1 + g}{1 + r} \) substitutes \( x \), then

\[
\frac{1}{1 - x} = \frac{1}{1 - \frac{1 + g}{1 + r}} = \frac{1}{1 + r - \frac{1 + g}{1 + r}} = \frac{1 + r}{r - g} \approx \frac{1}{r - g}
\]

By replacing \( \sum x^i \) with \( \frac{1}{r - g} \), the following is obtained:

\[ P_0 \approx E_0 \frac{1}{r - g} \]
\[ \frac{P}{E} \approx \frac{1}{r - g} \]
According to this equation, the P/E ratio and $\frac{1}{r-g}$ share an inverse relationship. That is, a decrease in the difference of the rate of return and the dividend growth rate induces an overall increase in the P/E ratio. The relationship that is derived between NPV and the current price of an asset is the principle reason why investors use the P/E ratio as a measure to dictate their investment decisions.

Also, the discount rate is composed of two variables—safe interest rate and a risk premium. If $r^*$ is the safe interest and $\sigma$ is the risk premium, then the equation above can be presented in the following manner:

\[
\frac{P}{E} \approx \frac{1}{r^* + \sigma - g}
\]

As suggested by the equation above, the P/E ratio, the safe interest rate and the risk premium share an inverse relationship. That is, a perceived decrease in risk or interest rate will increase the P/E ratio. On the other hand, if people expect an increase in the dividends growth rate, then the P/E ratio will also increase. Bubbles will form in the market when market agents make investment decisions based on the assumption that past increases in the P/E ratio will continue in future P/E ratios.

However, as suggested by the definition of economic fundamentals, there are two unknown variables that are used to capture the value of economic fundamentals. First, the rational expectation of an asset’s performance is an unknown variable. Due to the complexity of determining all the inputs that account for the future price of an asset, there is no way to establish the rational expectations of an asset’s performance. There are simply too many variables affecting the valuation of an asset’s future price to correctly predict the value. Because of this flaw, market participants tend to model the future
income stream of an asset (Tirole, 1982). The second unknown factor in calculating the value of economic fundamentals is the discount to apply to the future cash flows. In order to determine the discount rate, market participants must estimate the future rate of inflation. Similar to the difficulties experienced while estimating the future price of an asset, there are too many variables affecting the future rate of inflation. The inherent uncertainties in estimating the future income stream and discount rate are the reasons behind the debate over the existence of speculative bubbles.

Although the true value of economic fundamentals is difficult to determine, economists model the value of economic fundamentals through proxy variables. Such proxy variables include disposable income, population, GDP growth rate, unemployment, interest rates and inflation (Li & Chand, 2015; Flood & Garber, 1980). Once a set of proxy variables is established to model economic fundamentals, the next step is to determine the mechanism that gives rise to speculative behavior and allows asset prices to deviate from fundamental—propagating speculative bubbles.

When following the path of bubble development, the initial period of bubble formation is characterized by large price increases that can be justified by economic fundamentals. However, market participants anticipate larger increases in future prices, which do occur due to the self-fulfilling expectations of market participants. As explained before, the additional valuation of the asset that is not justified by economic fundamentals is based upon the speculative behavior of market participants. The additional price movement that is explained by speculative behavior is what causes the formation of bubbles (Flood & Garber, 1980; Li & Chand, 2015; Tirole, 1982). As market prices continue to rise, market participants assume that this occurrence is due to the availability
of new information and the rational decision-making of other participants. Eventually, market agents grow weary of the price increases because the valuation of the assets is not justified by economic fundamentals, and participants begin to withdraw from the market. The bursting of the bubble occurs when the expected price movements quickly disappears and begins to plummet, causing a crash in the market.

2.2: Greater Fool Theory

Another popularized theory in the discussion of the development of speculative price bubbles is the Greater Fool Theory. Asset price bubbles arise when market prices deviate from the fundamental value of assets. The difference between the market price and the economic fundamentals, which is the valuation of an asset based on speculative behavior, is called a “bubble” (Flood & Garber, 1980; Li & Chand, 2015; Tirole, 1982). According to John Maynard Keynes’ (1936) Greater Fool Theory, the market price of an asset is not primarily based on economic fundamentals, but is determined by the market’s irrational beliefs and expectations. The primary premise of the Greater Fool Theory is that agents are willing to pay more for an asset, despite knowing the low fundamental value of the asset, because agents anticipate selling the asset to someone else for a higher price (Keynes, 1936; Barlevy, 2015). While scrutinizing this theory, people commonly have one primary question. Why would someone be willing to buy an asset despite knowing its low fundamental value?

To answer this question, it is important to understand the concepts of speculative trading and asymmetric information and how they function within the Greater Fool Theory. By definition, a market agent who participates in speculative trading expects to profit at the expense of others. That is, speculative trading is a zero-sum game with no
mutually benefitting gains. Within the framework of the Greater Fool Theory, speculative trading describes the reasoning behind the agent’s willingness to purchase an asset with low fundamental value. Despite knowing the low fundamental value of an asset, an agent is willing to buy an asset at a high price because of the belief that the asset can be sold to a “greater fool.” In this case, the agent anticipates gaining a profit at the expense of someone else (Barlevy, 2015).

In addition to speculative trading, asymmetric information is a key feature of the Greater Fool Theory. Asymmetric information suggests that specific market participants have access to private information other participants may not be aware of. When this concept is applied to the Greater Fool Theory, agents are willing to buy an asset below fundamental value due to the possibility of selling the asset to a less informed agent (Barlevy, 2015). Asymmetric information is a fundamental component of the development of speculative bubbles because the access to new information influences a trader’s decision to sell, hold or buy an asset.

As described before, the initial period of bubble development is characterized by large price increases that can be justified by fundamentals. However, in the presence of asymmetric information and speculative trading, market participants anticipate larger price increases that are not justified by economic fundamentals. The Greater Fool Theory argues that asymmetric information and speculative trading activity will influence traders to buy assets with low fundamental value and sell the assets to a less-informed agent at a higher price (Barlevy, 2015). As this cycle of speculative trading continues, the price of assets superficially continues to rise and deviate from fundamental value. The additional price movement is what causes the formation of the bubble (Barlevy, 2015; Flood &
Garber, 1980; Li & Chand, 2015; Tirole, 1982). Eventually, market participants realize that the price increase is not justified by economic fundamentals and decide to withdraw from the market. The bubble bursts when expected price movement disappears and begins to plummet because information regarding the worth of the asset is available to all traders.

2.3: Positive Feedback Investment Strategy—Past Price Behavior

In recent years, economists have shifted their focus to behavioral finance as a plausible field of study to explain the propagation of speculative bubbles. Behavioral finance emphasizes the psychological forces that influence investor behavior. Within the sphere of behavioral finance, the approach of “positive feedback” trading is central to the development of speculative bubbles. According to this approach, traders have a tendency to exhibit trend chasing behavior because positive feedback traders are more inclined to buy assets as prices rise and sell when prices fall. Positive feedback trading is commonly practiced in financial markets such as stop loss orders, margin call liquidation, portfolio insurance, and most prominently in extrapolative expectations. Although all of these trading strategies are as equally as important, we will primarily focus on how past price changes influence extrapolative expectations and lead to large fluctuations in the value of traded assets (De Long, Shleifer, Summers, & Waldmann, 1990).

One of the most highlighted aspects of positive feedback trading is the trend-chasing tendency of traders, which is influenced by past price changes. De Long et al. (1990) report a psychological experiment in which subjects were asked to forecast stock price changes and perform trades consistent with their forecasts. In the study, the subjects were not given any other information that would change the fundamental value of the
stock except for information regarding past prices. It was found that the participants calculated past price averages when the stock prices were stable and traded against price variations. As the past prices began to show consistent patterns, traders exhibited trend-chasing behavior, buying more when prices increased and selling when prices decreased.

In a similar experiment, Shiller (2002) draws identical conclusion as De Long and his colleagues. According to his investigation, many psychological factors, such as intuition, feelings of confidence and self-esteem from past successes in investing and the personal association with price increases, encouraged people to expect past price changes to continue in the future. As prices begin to show consistent trends, positive feedback traders will indefinitely buy more when prices increase and sell when prices decrease; hence, contributing to the deviation of assets from their fundamental value.

Positive feedback trading creates the perfect conditions for the development of speculative price bubbles, because of the level of risk and uncertainty that is associated with this trading strategy. As discussed in the paragraph above, feedback traders make trading decisions based on extrapolated trends of past price changes (De Long et al., 1990; Shiller, 2002). This strategy of decision-making involves a great level of risk because of the uncertainty related to whether future prices will continue to follow the trend. Furthermore, based on the historical occurrence of bubbles and crashes, bubbles have significantly reduced since World War I. Due to this knowledge of bubble infrequency, trend chasing agents will only have the opportunity of learning about the error of their decision once the bubble has occurred. If the trend chasing agents’ extrapolated trends are validated by rising fundamentals, agents are likely to transpose
their short trend horizons to longer trend horizons and therefore, sustain rising prices and a bubble that is not justified by fundamentals (De Long et al., 1990).

The theoretical framework of bubble formation provides three dominate theories that describe the development of bubbles. According to the self-fulfilling expectations theory, the valuation of an asset is not only determined by a market participant’s valuation of an asset based on economic fundamentals, but also is reflective of the market participant’s speculative behavior. The difference between the market price and the economic fundamentals is called a bubble (Flood & Garber, 1980; Li & Chand, 2015; Tirole, 1982). Additionally, the Greater Fool Theory suggests that agents are willing to pay more for an asset, despite knowing the low fundamental value of the asset, because agents anticipate selling the asset to someone else for a higher price. In the presence of asymmetric information and speculative trading, market participants buy assets with low fundamental value and sell the assets to a less-informed agent (Keynes, 1936; Barlevy, 2015). Furthermore, the positive feedback approach describes the tendency of market agents to make trading decisions based on extrapolated trends of past price changes (De Long et al., 1990; Shiller, 2002). Based on the analysis of the theoretical framework of bubble development, it is evident that bubbles form when market agents use past information to make present investment decisions rather than the new information that is present in the market.
Section III: Famous Early Bubbles

Speculative asset price bubbles are not a recent phenomenon. History provides an array of examples of how asset prices can deviate from their fundamental values and give rise to bubble economies. Through the investigation of historic bubbles, we will gain a clearer understanding of speculative asset price bubbles. A historical review of bubbles will assist in recognizing the leading indicators of an economy prone to speculative behavior and plausible policies that will help prevent the development of bubbles.

3.1: Tulip Mania (1634-1637)—Netherlands

The Netherlands experienced the first formally recognized creation, propagation, and consequent crash of a bubble in the tulip market during the seventeenth century. In the late sixteenth century, the tulip was first introduced in Western Europe by Conrad Gesner, and it quickly became a symbol of economic and social status for merchants (Mackay, 1996). Tulip bulbs were a prized asset because of the difficulty in acquiring the bulbs due to limited number of professional growers.

However, after 1634, the price of tulips rose dramatically. As noted by Garber (1990), the dramatic increase in tulip prices was primarily accredited to the effects of the Mosaic virus on tulip bulbs. The Mosaic virus weakened the reproductive cycle of the plant. As an effect of its weakened state, tulips were subject to a phenomenon called “breaking,” which produced remarkable multicolored patterns on the flowers. With introduction of these infected bulbs in the market, prices for tulip bulbs rose to unprecedented levels. Not only did the multicolored species increase in price but in general, bulbs increased by approximately eightfold between 1634 and 1636 (Garber, 1989). In 1635, a tulip of a species called Admiral Liefen was worth about 4400 florins.
At the same time, an individual could purchase four fat oxen for 480 florins or 1000lbs of cheese for 120 florins (Mackay, 1996). Investors were willing to invest in the tulip market based on the potential of the rare tulips to increase in fundamental value. However, as prices continued to rise, the price increase was not justified by an expected increase in the economic fundamentals of bulbs. Investors continued to irrationally invest in bulbs and actively ignored the price that the bulbs could demand based on fundamentals (Mackay, 1996). Chang et al. (2016) argue that the optimistic and speculative behavior of investors is the initial catalyst of the Tulip Mania.

The Tulip Mania contributed to the development of the futures market in the Netherlands. Due to the lack of readily available credit, bulbs were made accessible to the public through the deposit of goods such as livestock and property. Also, the seasonality of the tulip bulbs meant that sellers traded options\(^1\) on tulip bulb futures. The futures market further incentivized the public to trade tulip options which facilitated the development of the Tulip Mania. Traders made large profits by buying low and selling options when prices rose (Mackay, 1996).

Also, traders optimistically inferred that affluent foreigners would purchase rare tulip bulbs regardless of price. This assumption was further solidified as the popularity of tulip bulbs continued to rise in the wealthy Dutch families (Chang et al., 2016). According to Chang et al. (2016), the over-estimation of the tulip bulb demand and the optimistic assumption of the traders regarding the demand from foreigners aided the development of the Tulip Mania.

\(^1\) Contracts of bulbs purchased at the market rate after the deposit was made.
By early 1637, traders soon realized that people were not willing to invest in the high-priced tulip bulbs and the bubble economy began to crash. As prices and confidence fell in the tulip bulbs, individuals who had purchased expensive tulip bulb futures suffered immensely. Many investors who had made deposits on bulbs during the boom period failed to fulfill their commitments. Moreover, the government and the courts of Holland refused to intervene and legally enforce payment to depositors of bulb options, because trading of contracts was classified as gambling by the courts. Thus, public credit also collapsed (Mackay, 1996). It is often thought that bursts of bubble economies occur overnight. However, this thought is a misconception of the autonomy of speculative asset bubbles. In the case of the Tulip Mania, tulip prices steadily decreased over the next few years. As calculated by Garber (1990), the average annual decline in prices for these bulbs for the remainder of the century was approximately 28%. Although the initial decline of tulip prices is associated with the collapse of the asset price bubble, the gradual decline that persisted over the remainder of the century is related to the change in preferences and the technological advancement of society (Garber, 1990).

3.2: The South Sea Bubble (1720s)—Britain

The South Sea Bubble represents the world’s first global financial bubble. The South Sea Bubble was fueled by the emergence of the South Sea Company, which was created by Hartley Earl of Oxford in 1711 as a method to provide funds to the British government following the War of the Spanish Succession (Garber, 1990). The structure of the arrangement was very similar to the one conducted by John Law in France with the Mississippi Company. Law proposed that to raise capital for a venture, entrepreneurs needed to make bold claims about their undertaking, and then sell shares at increasing
prices. The ability of the venture to generate revenue raised public confidence in the shares; hence, stabilizing the prices (Garber, 1990). The South Sea Company exemplified John Law’s rationality of one such venture. The company was effective in writing off the government debt with the methodology described by John Law (Chang et al., 2016).

Additionally, as a part of the agreement, the government granted the South Sea Company exclusive rights on trade via the “South Seas” and paid the company a 6% interest payment. However, British trade with South America was blocked by the Spanish because Spain controlled the eastern ports of South America (Garber, 1990). Although the South Sea Company maintained a limited monopoly, the promotion of the company’s monopoly on trade and the government decision to allow the company to set share prices independently on stock issues, further overstated share prices (Chang et al., 2016). The innovation of financial instruments to finance the debt of the government via corporate stock in the South Sea Company is a major factor that contributed to the development of the South Sea Bubble (Frehen, Goetzmann, & Rowenhorst, 2013).

Despite the South Sea Company’s limited monopoly, the South Sea Company maintained a strong public confidence. In 1717, George I, King of England, concerned with the state of public credit, suggested that Parliament take proper measure to reduce national debt. The South Sea Company and the Bank of England, being the great monetary corporations of the period, recognized the advantages of accepting a debt from the government—an interest payment of approximately 5% to the company and legislative support for limited competition (Mackay, 1996).

After several attractive proposals made by both corporations, the House of Commons accepted the proposal of the South Sea Company. As predicted by the owners
of the South Sea Company, the value of company stock gradually rose from £130 to £330 (Mackay, 1996). However, the acceptance of the South Sea Company’s proposal was highly controversial. Reportedly, members of the House of Commons and House of Lords owned stock in the South Sea Company. Due to their partiality towards the South Sea Company, the House of Commons and House of Lords deliberately voted on behalf of the Company. The support from the House of Commons and rumors of improved relations with Spain aided in raising the value of South Sea Company stock (Garber, 1990; Mackay, 1996).

In addition to the innovation of government finance, the South Sea Company also sold company shares as subscription shares to make the scheme appealing to more investors which aided in growing the valuation of shares. To buy subscription shares, investors were required to provide a down payment and schedule installments in order to get a certain number of shares. This scheme allowed the company to raise capital quickly (Chang et al., 2016). Shea (2007) argues that subscription shares were perceived as call options by owners. Although investors were obliged to pay for subscriptions, they had the option to default in the future if the subscription did not seem profitable (Shea, 2007). As described by Chang et al. (2016, p.498), “this would be a cost-effective strategy when the share price of the company was sufficiently below the price of the subscription, making the subscription a more expensive means of purchase.” Shea (2007) claims that the development of new financial instruments, such as the subscription shares allowed the bubble to expand as a wider audience was available to purchase the shares.

The success of the South Sea Company encouraged the emergence of numerous joint-stock companies. These companies, which later became known as Bubbles amongst
the public, survived weeks and sometimes a few days, before their inflated stock prices collapsed. Accounts of these companies show that one company acquired approximately half a million in capital with the slogan, “A company for carrying on an undertaking of great advantage, but nobody to know what it is” (Mackay, 1996, p. 78). The frenzy amongst the crowd to gain riches allowed these companies to defraud the public.

In the third quarter of 1720, the share prices of the South Sea Company significantly fell. The plummeting South Sea stock prices and the bursting of the South Sea Bubble occurred simultaneously. Many shareholders were unable to afford the subscription shares and defaulted, which reduced the cash flow from the subscription shares (Chang et al., 2016). Although the Company could set its own share prices, the willingness of the people to buy such high prices fell. As confidence fell in the South Sea Company, it diminished the interest of the public in similar joint-stock companies. Similar events were occurring internationally like the collapse of the Mississippi Company in France. This caused the share prices of the South Sea Company to fall even more (Frehen et al., 2013). The bursting of the South Sea Bubble was the result of the diminishing confidence of the public in the valuation of the South Sea Company, which triggered widespread speculation concerning the success of other joint-stock companies. As a result of the bursting of the South Sea Bubble, the Parliament of Great Britain enacted the Bubble Act, which restricted the trading of shares without the permission of the government and it acted as an instrument to control inflating share schemes (Frehen et al., 2013).
3.3: The Railway Mania (1845-1847)—Britain

Shortly after the Industrial Revolution, a widespread enthusiasm for investing in railway shares promoted the British Railway Mania during the mid-1840s. The early success of railways as an effective method of transporting goods and passengers during the Industrial Revolution propagated the development of over 1,951 miles of railway tracks in Britain (Campbell, 2014). The Industrial Revolution created new wealth for middle-class families. This new-found wealth encouraged families to invest in the development of railway track and earn riches. The active participation of common people contributed to unique nature of the Railway Mania.

Like the South Sea Bubble, as an effort to attract more investors, railway companies also offered subscription shares to potential investors. A few companies demanded 10% of the share’s value as a down payment, while reserving the right to demand the remaining 90% at any time (Chang et al., 2016). Campbell (2014) notes that the innovation of the subscription shares leveraged the returns which investors could obtain. That is, investors could produce a larger return on assets for a small deposit. The overwhelming success of the railway projects, the creation of new wealth, and the financial innovation of shares allowed middle-class families to invest in these schemes (Chang et al., 2016). Campbell (2014) and Chang et al. (2016) conclude that the investor speculation concerning the unexplored potential of railways and the financial innovation of share instruments were the two leading drivers of the Railway Mania.

In addition to the subscription shares and the creation of new wealth, the lack of government regulation and supervision acted as a key driver of the Railway Mania. The
annulment of the Bubble Act of 1720\(^2\) allowed railway companies to sell shares without government supervision (McCarty & Arnold, 2003). Additionally, if Parliament had prohibited the use of partially-paid shares by requiring new projects to collect a larger share of the total cost of lines before the project was considered authorized, then this requirement would have reduced the effects of leverage on the investments (Campbell, 2014). The annulment of the Bubble Act of 1720 and the lack of Parliament’s active participation in these investments contributed to the enhancement of the Railway Mania because, railway companies acted without any repercussions.

Despite the overwhelming excitement surrounding railways, the railway shares began to plummet by 1847, marking the collapse of the Railway Mania. There are two main reasons behind the burst of the Railway Bubble. First, the difficulty of constructing railways was realized once the construction of several rail projects began (Chang et al., 2016). Second, the burst of the bubble is associated with the market realization that the technology of railways would not have the potential to sustain success as previously thought by investors (Chang et al., 2016). As a result, railway shares declined by 18.2% between their peak in August 1845 and the end of November 1845. The prices continued to decline until April 1850—a decrease of 57.5% (Campbell, 2014). Interestingly, due to the extensive construction of railway lines (approximately 6,123 miles of line by 1850), the returns on investments rapidly declined. The increased competition led to a decline of the dividend/par ration from 7% in 1847 to 2.4% by 1852 (Campbell, 2014). The collapse

\(^2\) The Bubble Act of 1720 was enacted following the crash of the South Sea Bubble. The main purpose of the Bubble Act was to restrict the trading of shares without the permission of the government and to control inflating share schemes (Frehen et al., 2013).
of the Railway Mania is indicative of the detrimental effects of asset price bubbles on the economy as initial euphoric decisions lead to loss of future wealth.

The investigation of the Tulip Mania, South Sea Bubble and the Railway Mania reveal the primary catalysts of historical bubbles. Although these historical cases occurred in unique economic conditions, there are similar catalysts of bubbles presented in these case studies. First, due to the lack of a developed capital market, risky financial innovations act as a catalyst of historical bubbles. During the Tulip Mania, we witnessed the emergence of the futures market in the Netherlands, which incentivized the public to trade tulip options (Mackay, 1996). Furthermore, both during the South Sea Bubble and the Railway Mania, companies offered subscription shares to investors, which aided in the making the scheme more affordable for investors (Chang et al., 2016). Second, lax financial and commercial regulations act as a key catalyst in the formation of these historical bubbles. During the South Sea Bubble, “Bubbles” issued stock with promises of high returns but how high returns would be achieved, was never disclosed (Mackay, 1996). In a similar manner, during the Railway Mania, the annulment of the Bubble Act of 1720 allowed railway companies to sell shares without the supervision of the government (McCarthy & Arnold, 2003). The analysis of early famous bubbles reveals that risky financial innovation and lax financial and commercial regulations act as key catalysts of bubble development.
Section IV: Modern Bubbles

In contrast to the previous section, modern speculative asset price bubbles are quite complex in nature because these bubbles form within developed economies. Through the investigation of modern bubbles, we will understand how modern economic bubbles are similar/different than famous early bubbles. A comparison of modern and historical bubbles will assist in recognizing the leading indicators of a developed economy susceptible to speculative behavior.

4.1: Japan’s Baburu Keiki (1980s)—Japan

After experiencing remarkable constant economic growth post-World War II, the Japanese entered a bubble economy in the late 1980s. Economists Hamada and Okada (2009) argue that the creation of Japan’s asset price bubble can be traced to Japan’s monetary and international policies, which created the perfect environment for a speculative bubble. More specifically, one of the primary catalysts of Japan’s bubble economy was the restrictive monetary policies set by Japanese Prime Minister Hashimoto during the Plaza Accord in 1985 as an attempt to correct for the current account deficit in the United States. By devaluing the American dollar with respect to the Japanese Yen, the Japanese aided the U.S. reduce its national debt because America’s purchasing power was significantly less than Japan. However, the Japanese Yen became extremely overvalued in comparison to the American dollar, and this created a negative term of trade. The appreciation of the real exchange rate hurt the welfare of the Japanese economy by increasing the competitive conditions in Japanese industries for exports and imports (Hamada & Okada, 2009). To counteract the appreciating real exchange rate, Japan was pressurized to sign the Louvre Accords in 1987 by America. In response to the
Louvre Accords, Japan enacted a loose monetary policy which lowered the discount rate and provided the perfect financial conditions for speculative behavior in the Japanese economy (Hamada & Okada, 2009).

In addition to the relaxed monetary policy, the Japanese engaged in the financial liberalization of the banking sector during the 1980s which facilitated speculative behavior in the economy. Due to financial liberalization, banks became involved in more risky investments without being closely monitored by the government. Fukao (2003, p.368) states that “banks exclusively relied on collateral and paid little attention to the cash flow of underlying business.” Rather than reprimanding the actions of banks, many financial institutions were encouraged to engage in high-risk opportunities because the Bank of Japan followed the policy of “forgiveness and forbearance” when these financial institutions were in trouble (Cargill, Hutchinson, & Ito, 2000). For example, the Japanese keiretsu (lineage) system, a closely-knit grouping of commercial and financial institutions, engaged in risky activity during the period of deregulation. The companies within each keiretsu had an established bank managing the transfer of funds between the capital rich and capital poor commercial operations. The keiretsu were able to engage in risky activity during Japan’s deregulation, because it was widely known that the Japanese government would not allow such large institutions to fail. Also, bankruptcy was a rare occurrence within Japan’s large and most politically connected business firms because of the keiretsu system (Cargill & Parker, 2003). Financial liberalization created the perfect conditions for an asset price bubble, because firms and households were easily able to engage in risky behavior with the support of the government.
Furthermore, tax distortions increased the customer-base of the banking sector for real estate loans and increased the value of land in Japan (Fukao, 2003). The inheritance tax in Japan until 1988 was 75% for over 500 million yen and over 70% for over 2 billion yen of inheritance. This high tax incentivized wealthy individuals to borrow money and buy land because the effective property tax rate on land was about 0.1% of the market value (Fukao, 2003). As the demand of land significantly increased, the price of land began to rise which as well led to less diversification of bank’s loan portfolios (Fukao, 2003).

![Nikkei 225 Index](image)

In the early 1990s, the burst of the Japanese asset price bubble occurred. The burst of the bubble had detrimental effects on the economy. After reaching its peak in 1989, the Nikkei 225 Index declined by over 50% during the following 18 months as demonstrated in FIGURE 1 above. As a result, land and real estate prices began to fall in 1991 and continued to do so for the remainder of the decade (Cargill et al., 2000). The period
subsequent to the bubble economy is formally recognized as “Japan’s Lost Decade.” This period is characterized by long-lasting stagnation in real economic growth, and a tightened monetary policy as an attempt to re-establish the value of the yen. By the early 2000s, Japan was gradually recovering from its recessionary period, but the Great Recession negatively impacted Japan’s ability to recover (Hamada & Okada, 2009).

4.2: Dotcom Bubble (1995-2000)—United States

The Dotcom Bubble began in the mid-1990s, after the transition of the traditional business model from the brick-and-mortar company to the brick-and-click company due to the introduction of the World Wide Web. New excitement was created due to the unexplored potential of the internet in the world of commerce (Cassidy, 2002). Additionally, the success of early Dotcom companies such as Amazon facilitated the emergence of new companies that adopted Jeff Bezos’ model of Get Big Fast. The idea behind this model was very simple. Rather than pursuing marginal growth, this strategy advocates for the use of aggressive tactics to capture the majority market share and to cultivate premier brand recognition in order to increase opportunities for customer acquisition and retention (Crain, 2014). For example, Amazon was spending unprecedented amounts of capital to alert people of its existence. For every $20 book Amazon sold, it was paying $16 to buy and ship each book, $8 in advertising and $1 in overhead, bringing its total cost per book to $25 (Cassidy, 2002). The combination of a new business model and the speculative potential of the Dotcom companies created new demand amongst investors and stockholders.

The speculative behavior of investors contributed to the overpricing of Dotcom stocks and the expansion of the Dotcom Bubble. Traditionally, investors cautiously
invested capital into start-up companies by critically examining the profitability, business model, the reliability and the fundamental value of the company. However, venture capitalists during the Dotcom Bubble did not consider these measures. Driven by the idea that at least one of these companies would be the next EBay or Amazon, venture capitalists poured unprecedented amounts of capital into these Dotcom startups (Crain, 2014). Annual venture capital investment grew from about $7 billion in 1995 to nearly $100 billion in 2000. From 1990 to 2000, while the number of dotcom companies grew from 1050 to 6420, the number of venture capital firms only doubled (Crain, 2014). The decision of venture capitalists to actively ignore available fundamental information gave rise to speculative behavior and acted as a catalyst of the Dotcom Bubble (Crain, 2014).

In comparison to previous asset price bubbles the expansion of the Dotcom Bubble was significantly influenced by herding behavior. A study conducted by Singh (2013) concluded that institutional investors invested into internet stock with high intensity during the rise in prices between December 1997 and March 2000. Singh (2013) used the Lakonishok, Shleifer and Vishny [LSV] measure of herding to measure the intensity of herding present during the Dotcom Bubble. For the overall period, Singh (2013) calculated the herding intensity of internet stocks as 6.58%. These results reveal that during the Dotcom Bubble investors were not acting independently. Rather, influenced by the actions of others, investors actively ignored fundamental information to gain possible riches.

Furthermore, one of the central factors that contributed to the development of the Dotcom Bubble was the actions of the Federal Reserve Bank. In order to understand the impact of Alan Greenspan’s policies during the Dotcom Bubble, it is important to reflect
on the direct relationship between the Federal Reserve and the stock market. When the Federal Reserve cuts interest rates, stock prices go up. A fall in interest rates reduces the cost of borrowing, which allows firms and consumers to spend more on luxury goods and helps raise corporate earnings. Furthermore, as interest rates decrease, the P/E ratio of an asset increases which makes the perceived value of an asset higher in the eyes of an investor. On the other hand, an increase in interest rates by the Federal Reserve has the opposite effect on stock prices, cost of borrowing, spending and corporate earnings (Cassidy, 2002). Instead of increasing interest rates to counteract the effects of the initial boom period in the Dotcom Bubble, Greenspan chose not to act accordingly (Cassidy, 2002). By deciding not to increase interest rates, Greenspan contributed to the rising share prices and the irrational development of the Dotcom Bubble.

The collapse of the Dotcom Bubble occurred in early 2000. Greenspan and the Federal Reserve hiked up interest rates and as expected, the increase in interest rates
slowly impacted the internet shares in the stock market. As seen in FIGURE 2 above, since peaking on March 10, 2000, the NASDAQ had dropped 1,727 points, or 34%. The Dow Jones Composite Internet Index was down 53%. In a span of one week, $2 trillion of the stock market had disappeared (Cassidy, 2002). After the first hike in interest rates, investors began cautiously evaluating internet companies. Investors began to evaluate the dotcom companies with traditional measures of success such as P/E ratios. The shares of the dotcom companies were reaching an all-time low due to the absence of a sound business model, lack of business experience, and the tendency of companies to overspend on marketing and IT infrastructure (Razi, Tarn & Siddiqui, 2004). Greenspan’s decision to increase interest rates helped demonstrate the irrationality of investing in dotcom companies, and led to the collapse of the Dotcom Bubble.

4.3: The Housing Bubble (1999-2010)—The United States

Shortly after the Dotcom Bubble, the U.S. underwent the largest financial crisis since the Great Depression. This financial crisis was triggered by a crash in the U.S. housing market, known as the ‘credit crunch’ (Chang et al., 2016). The rise of the U.S. Housing Bubble was caused by a conglomerate of economic policies. As noted by Gjerstad and Smith (2009), the expansion of the Housing Bubble was fueled by a wider availability of mortgage credit, which was facilitated by the U.S. expansionary monetary policy. The initial run-up in housing prices was triggered by the Taxpayer Relief Act of 1997, which led to an increase flow of capital to the housing market, causing an increase in demand, and a rapid increase in house prices (Gjerstad & Smith, 2009).

In combination with the Taxpayer Relief Act of 1997, the Federal Reserve also maintained a low interest rate which contributed to the development of the Housing
Bubble in two ways. First, low short-term interest rates prompted the use of adjusted rate mortgages (ARMs). Potential home buyers who initially were unable to afford house payments under a fixed rate, could do so through ARMs. ARMs made monthly mortgage payments affordable for more buyers and therefore, encouraged the rising home prices (Holt, 2009). Second, the low short-term interest rates promoted housing by encouraging leveraging. Due to the low short-term interest rates, investors could increase their returns by borrowing at a low interest rate and then by investing in higher yielding long-term investments. Leveraging contributed to rising home prices by increasing the financing available for mortgage lending (Holt, 2009).

In addition to the expansionary monetary policy, the financial liberalization of the banking industry further expanded the U.S. Housing Bubble. Chang et al. (2016) points out that mortgage applicants were easily able to borrow credit for mortgages without serious credit checks. Under the Community Reinvestment Act of 1995, banks were required to increase their mortgage lending to low-income households so that there would be an increase in home-ownership rates. In order to adhere to these guidelines, many banks relaxed their standards for mortgage lending—reduced requirements for down payments and income (Holt, 2009).

In addition to lax regulations, banks actively participated in the financial engineering of investment instruments. According to Chang (2011), the aim of financial engineering is to create specialized investment instruments to diversify funding instruments and aid in credit flow. During the U.S. Housing Bubble, banks lent significant amounts of funds to subprime mortgages via lending vehicles such as ARMs, collateralized debt obligations (CDOs), credit default swaps (CDS), collateralized
mortgage obligations (CMOs) and mortgage backed securities (MBS) (Chang, 2011). The financial engineering of lending instruments helped accelerate the U.S. Housing Bubble because banks were encouraged to participate in risky lending practices.

Soon after, the expanding U.S. Housing Bubble collapsed in 2007. Chang et al. (2016) accredits the collapse of the U.S. Housing Bubble to the risky investment practices by banks which led to numerous bank-runs. As a result of risky investment practices, there was an increasing rate of foreclosures. In comparison to 2006, the foreclosure rate increased by 75% in 2007 (Holt, 2009). A majority of these foreclosures consisted of subprime mortgages and ARMs. Banks found it increasingly difficult to resell mortgages. As this occurred simultaneously across banks in the nation, banks were forced to close and the loss of credit led to increasing debts (Chang et al., 2016). The effects of the financial crisis that persisted after the collapse of the U.S. Housing Bubble formally became recognized as the Great Recession.

The review of Japan’s Baburu Keiki, the Dotcom Bubble and the U.S. Housing Bubble reveal the common catalysts of modern economic bubbles. In the more developed economies of the U.S. and Japan, a primary catalyst of speculative bubbles is an expansionary monetary policy. During Japan’s Baburu Keiki, Prime Minister Hashimoto enacted a loose monetary policy in order to counteract the appreciating real exchange rate of the Yen. As a result of his actions, the discount rate was significantly lowered and provided the perfect financial conditions for speculative behavior (Hamada & Okada, 2009). Also, during the Dotcom Bubble, Alan Greenspan implemented an expansionary monetary policy by maintaining a low interest rate despite the rising share prices of dotcom companies. The low interest rate continued to fuel the rise of share price of
dotcom companies due to the direct relationship between interest rates and stock prices (Cassidy, 2002). In addition to an expansionary monetary policy, the lack of government regulations acts as a key catalyst of modern bubbles because financial institutions are encouraged to engage in high-risk opportunities. This type of risk-taking behavior was seen during both Japan’s Baburu Keiki and the U.S. Housing Bubble, which significantly powered the development of the respective bubbles. The analysis of modern bubbles shows that the common catalysts of modern bubble are an expansionary monetary policy and relaxed government regulations.
Section V: Analysis of Bubbles—Catalysts and Drivers of a Bubble

Based on our historical cases, it is evident that there are many factors that act as catalysts and drivers in the formation of speculative bubbles. In this section, our primary aim will be to compile a list of catalysts, which are most common within our historical cases of bubbles. First, the most prominent catalyst in the formation of asset price bubbles is monetary expansion (Roy & Kemme, 2012).

During the Dutch Tulip Mania, monetary expansion acted as a primary catalyst in the formation of the asset price bubble because the introduction of tulip options allowed people to pay a small fraction of the bulbs’ price and bid on an option to buy. The tulip options assisted in making credit available in the market to varied income-leveled individuals, which encouraged the trade of options and increased the price of the tulip bulb in the market (Mackay, 1996).

From the three modern bubble case studies, a loose monetary policy is a key catalyst of each speculative bubble. During Japan’s Baburu Keiki, the expansionary monetary policy encouraged the severe escalation of asset and land prices. Prime Minister Hashimoto enacted a loose monetary policy to re-establish Japan’s exports to the U.S. after the devaluation of the Yen with respect to the U.S. dollar. The loose monetary policy lowered the discount rate and provided the perfect conditions for speculative behavior (Hamada & Okada, 2009). One of the primary catalysts in the Dotcom Bubble was the Reserve Bank’s decision to preserve a loose monetary policy despite the speculative behavior present in the market. The expansionary monetary policy sustained by Alan Greenspan contributed to the rising share prices due to the direct relationship between interest rates and stock prices (Cassidy, 2002). The U.S., our most recent bubble
example, also experienced monetary expansion which contributed to rising asset and land prices. Due to the low interest rates, banks used ARMs to encourage more prospective home buyers. Also, the low short-term interest rate promoted rising home prices through leveraging (Holt, 2009). The expansionary monetary policy fueled the U.S. Housing Bubble because as the demand for mortgages increased, home prices rose as well.

Another leading catalyst in the formation of speculative bubbles is lax financial and commercial regulations. In early asset price bubbles, this catalyst is seen when governments allowed companies to issue stock without requiring disclosures and policies that would protect investors. The primary example of such an occurrence is the South Sea Bubble. Under many circumstances, ‘Bubble’ companies issued stock with promises of high returns but how high returns would be achieved, was never disclosed (Mackay, 1996). In a similar manner, during the Railway Mania, the annulment of the Bubble Act of 1720 allowed railway companies to sell shares without the supervision of the government (McCarthy & Arnold, 2003). The lack of government supervision encouraged risky investments because no governmental institution was protecting investors.

For modern speculative bubbles, Crotty (2009) reasons that New Financial Architecture (NFA), the integration of modern day financial markets with light to no government regulations, is the primary structural cause of asset price bubbles. In both the speculative asset bubbles of Japan and the U.S., the lack of financial and commercial regulation were leading contributors to the speculative behavior present in both economies. First, during Japan’s Baburu Keiki, many financial institutions were encouraged to engage in high-risk opportunities because the Bank of Japan followed the
policy of “forgiveness and forbearance” when these financial institutions were in trouble (Cargill et al., 2000). Due to the support of the government and risky investment opportunities, financial liberalization created the perfect conditions for an asset price bubble in Japan.

During the U.S. Housing Bubble, individuals without sufficient credit history were easily able to borrow credit for mortgages without serious credit checks (Chang et al., 2016). The relaxed standards for mortgage lending allowed individuals without sufficient funds to own homes. As the demand and ownership of homes continued to rise, the price of homes also increased. The lack of financial regulations allowed banks to engage in risky behavior which encouraged the development of the U.S. Housing Bubble. Through these case studies, it is evident that the government must play a key role in maintaining a stable economy. The government must employ certain policies that can regulate risky and irrational behavior in the market to prevent the development of asset price bubbles.

One final catalyst in the formation of bubbles is risky financial innovations (Roy & Kemme, 2012). Risky financial innovations were the key catalyst in early bubbles because in many cases, financial markets were not fully developed. During the South Sea Bubble, the South Sea Company sold company shares as subscription shares in order to make the scheme more appealing to investors. The subscription shares aided in the growing valuation of the company shares by making the scheme more affordable for investors (Chang et al., 2016). Similar to the South Sea Company, during the Railway Mania, railway companies offered subscription shares to investors. The financial
innovation of subscription shares encouraged the participation of middle class families which increased the price of railway shares (Chang et al., 2016).

The U.S Housing Bubble is the most recent example that was triggered by risky financial innovations. In order to follow the regulations of the Community Reinvestment Act, banks participated in the financial engineering of investment instruments. Banks lent significant amounts of funds via financially innovated vehicles such as ARMs, CDOs, and CMOs (Chang, 2011). The financial engineering of lending instruments helped facilitate the development of the U.S. Housing Bubble by allowing people with insufficient credit or funds to own homes. Overall, risky financial innovations are a key catalyst for the formation of asset price bubbles, because it encourages the participation in risky investment and lending practices.
Section VI: Bubble Development in Emerging Economies: China and India

In this section of the paper, we will be analyzing the possible existence of speculative bubbles in emerging economies. The primary focus of this section is on the emerging economies of China and India because while these countries play an integral role in the global economy, they are also experiencing unprecedented economic growth. This research is significant in the understanding of bubble development because the catalysts of bubbles in emerging economies may be different than developed economies. Therefore, this section of the paper will complete the anatomy of catalysts that promote the development of speculative bubbles.

6.1: China’s Stock Market

Following the U.S. ‘credit crunch’, economists have shifted their focus to the volatility of China’s stock market. As of late, China has suffered from plummeting stock prices, which has had several international and domestic repercussions. As illustrated in FIGURE 3 below, in 2008 and 2011, the Shanghai Composite Index lost 70% and 22% of its value, respectively (Liang & Willett, 2015). This instability in China’s stock market has led to question whether China’s government can implement counteracting regulations and policies to protect against the effects of speculation and the resulting bubbles. As discussed early, in order to implement the correct policies and regulations, it is important to understand the source of China’s volatile stock market.
Although it is understandable that China’s stock market will suffer from some turbulence due to the lack of maturity, there is one factor that raises concern for speculative behavior and the possibility of a bubble in the stock market. That factor is the increasing flow of “hot money” in China’s economy (Guo & Huang, 2010). Hot money refers to the flow of speculative funds from one country to an international country in the hopes of earning a short-term profit. It is estimated that the aggregate hot money that flowed into China from 2003 to 2008 was approximately 104% of China’s total foreign exchange reserves (Guo & Huang, 2010).

The large influx of hot money has two main effects on China’s economy, which contributes to the development of a volatile stock market. First, the inflow of hot money influences a rise in property demand and in turn, drives prices up as well as market capitalizations and stock index gains. In China, the entry of hot money created a booming
market which allowed foreign investors to make large sums of profit. Second, the presence of hot money created a great level of instability in the Chinese financial markets due to the nature of short-term investing (Guo & Huang, 2010).

Because of the nature of short-term investing, asset prices in China exceeded their market fundamentals as investors continued to flood an already capital saturated market. The inflow of hot money fueled further deviation from fundamental values as there was a perception of a booming market. However, as soon as asset returns suggested that assets were overvalued, there was an instantaneous outflow of hot money before assets fell even more. As this cycle of inflow and outflow of hot money continues, China’s government has difficulty maintaining a stable market and in turn, this causes a rise in speculative behavior in the stock market and other markets such as real estate.

6.2: China’s Housing Market

Unlike other developed economies, the Chinese economy has experienced rapid economic growth since the 1970s, with its GDP growing at a rate of 10% per year (Yao, Luo & Wang, 2014). This rapid economic growth has raised people’s standard of living and incomes exponentially, prompting a rise in demand for consumer goods and urban housing in particular. While a mild rise in prices and housing demand is normal for a country’s development, in the Chinese housing market prices are rising too rapidly which is making houses unaffordable for a vast majority of urban residents. The rapid increase in Chinese house prices is very similar to the magnitude observed during the U.S housing bubble. Tan and Wu (2014) find that the average growth rate of the Case-Shiller home price index between 1997 and 2006 was about 9.49% in the U.S. Meanwhile, the average growth rate of the Chinese house price index between 2002 and 2011 was 6.97% despite
the world financial crisis in 2008. This Chinese housing boom sparks the fear of another real estate bubble in a large economy, which can have detrimental effects on an economy slowly recovering from the Great Recession. In order to understand the source of this fear, it is important to evaluate the factors that are contributing to the increasing home prices of China and possibly creating a speculative bubble.

One of the primary reasons behind the increase in housing demand in China is the lack of a developed capital market. Developed economies such as the U.S. have easy access to investment instruments like stocks, bonds, and international financial assets which allow diversity in investment portfolios. Furthermore, in matured markets, these investment instruments are also more stable whereas in China, the stock market suffers from great levels of volatility (Guo & Huang, 2010; Liang, 2015). In China, the largest single component of a typical household’s asset portfolio is a housing asset. Reportedly, on average, a typical Chinese household’s housing asset accounts for almost 85% of a household’s nonfinancial wealth (Tan and Wu, 2014). The current financial situation of China is very similar to Japan during the bubble economy of the 1980s. After experiencing remarkable constant economic growth post- World War II, the Japanese entered into a bubble economy which was fueled by the increasing demand of land. As the demand of land increased, the price of land began to rise which as well led to less diversification of bank’s loan portfolios (Fukao, 2003). Drawing from the observations made during Japan’s Baburu Keiki, the lack of portfolio diversification in China is triggering an increase in house prices which is a sign of a bubble economy.

Another factor that is significantly impacting the rise in housing demand is the rapid urbanization of China (Tan & Wu, 2014; Yao, Luo & Wang, 2014). The increase in
urban population is primarily due to the large influx of foreign direct investment (FDI) in the real-estate sector. As seen in FIGURE 4 below, China has consistently had a greater total inflow of FDI than both the U.S. and India. In 2000, real-estate development made up 8% of China’s total FDI inflow. By 2011, real-estate development accounted for 23% of China’s total FDI inflow. That is, a percent change of approximately 187.50% from 2000-2011 (Yao, Luo & Wang, 2014). As a result of the increase in FDI inflow, China’s rural population has migrated to urban cities in search of new employment opportunities. However, at the same time, there is a lack of low-rent housing available for rural workers. The low availability of affordable homes for rural workers is primarily due to the fact that Chinese developers are able to earn a higher investment return by selling more expensive homes than low-rent homes (Yao, Luo & Wang, 2014). Therefore, the profit-earning incentive of developers and the growing demand for houses contributes significantly to the rising home prices.
In addition to China’s lack of investment channels and rapid urbanization, the Chinese government has also implemented an expansionary monetary policy which has influenced the rise of home prices. Prior to the Global Financial Crisis (GFC) initiated by the U.S. housing bubble in 2008, China’s monetary policy was best described as being very conservative. However, in an effort to avoid a potential economic downturn caused by the GFC, the Chinese government employed a loose monetary policy by increasing the money supply and greatly relaxing credit conditions (Chiang, 2016). Referring back to Japan’s Baburu Keiki, Prime Minister Hashimoto had enacted a loose monetary policy to re-establish Japan’s exports to the U.S. after the devaluation of the Yen with respect to the U.S. dollar. The loose monetary policy lowered the discount rate and provided the perfect conditions for speculative behavior, encouraging a severe escalation of asset and land prices (Hamada & Okada, 2009). Currently, due to its expansionary monetary policy, China is also experiencing a similar situation as Japan. Although the expansionary monetary policy has assisted the Chinese economy avoid a deep recession, it has also caused high inflation and a heated urban housing market (Chiang, 2016). Rather than stabilizing the Chinese economy, the loose monetary policy has triggered an increase in home prices which is adding to the development of a possible speculative bubble.

The presence of rapid urbanization, an expansionary monetary policy and an underdeveloped capital market hints at the fact that China is amid a real estate bubble of its own. If adequate measures are not taken by the Chinese government to control the rising home prices, then we may be suffering from another severe global recession.
6.3: India’s Property Bubble

Following China’s housing bubble, another prime concern of economists and policymakers is the potential property bubble blooming in India. Unlike developed economies, emerging economies such as India and China, are undergoing rapid economic growth which has created volatile markets. FIGURE 5 below provides a comparative illustration of the annual GDP growth rate of the U.S., China and India. As seen in FIGURE 5, China and India have been economically growing at a rapid pace. On the other hand, the U.S. has maintained an annual GDP growth rate approximately equivalent to 2% since 2001. As of 2015, while maintaining an annual population growth rate of 1.2%, India was also experiencing an annual GDP growth rate of 7.6%. This rapid economic growth and steady growth in population has simultaneously raised the standard of living and income in India, but has also prompted a rise in demand for consumer goods and urban housing. While a mild rise in housing prices is sustainable, India’s rising housing prices are predominately concentrated in metropolitan areas like Mumbai, New Delhi and Bengaluru, which gives rise to speculative behavior (Singh, 2014). In 2006, Himanshu Joshi (2006), director of Reserve Bank of India, reported that India’s real estate market was recording an annual price appreciation of 10% or more. While the global economy is still recovering from the Great Recession, a potential speculative
bubble in the emerging economies of both India and China sparks the fear of deepening the recessionary state of countries around the globe.

One of the primary factors that is currently influencing the rise in housing demand is India’s rapid urbanization. In 2006, the Urban Land (Ceiling & Regulation) Act was repealed by the central government. The Urban Land Act encouraged an investment climate because the act allowed for easy foreclosures and granted permission for FDI to make investments in the real estate market. FIGURE 4 on pg. 41 illustrates the direct impact of the Urban Land Act in India. From 2005 to 2006, FDI inflow increased by 142.2%. Because of the increase in FDI inflows, India has exponentially seen a rise in job opportunities in urban areas (Joshi, 2006). Reportedly, in 1901, urbanization in India was only 11%. However, by 2011, urbanization increased to 31% and it is expected to reach 41% by 2030 (Singh, 2014). Although urbanization is a sign of economic growth and advancement, in recent years, this has caused a scarcity in housing. Like China, there is a
lack of affordable housing available to low-earning workers because Indian developers can earn a higher investment return by selling more luxury homes. Due to this scarcity, there has been a substantial rise in the home prices of metropolitan areas, some even exceeding prices in Tokyo and London (Gopalan & Venkataraman, 2015; Singh, 2014).

In addition to India’s heated investment climate, India also maintains an expansionary monetary policy characterized by low interest rates and relaxed credit conditions (Singh, 2014). As mentioned before, an expansionary monetary policy fuels the speculative behavior of market participants, because of the relative ease of borrowing capital. Referring to the U.S. housing bubble, due to the low interest rates, banks encouraged prospective home buyers to purchase homes through new financial innovations such as ARMs and CDOs (Holt, 2009). In a similar way, under these low interest rate conditions, India has developed new financial innovations, such as the Mortgage Risk Guarantee Funds which provide default guarantee for housing loans up to 5 lakhs rupees without any collateral for security, to incentivize prospective home buyers (Singh, 2014). Fueled by the expansionary monetary policy, the relative demand of houses in Indian metropolitan areas continue to rise and in turn, so does the price of homes.

In most recent news, in late 2016, Prime Minister Narendra Modi implemented a demonetization plan in order to curb the use of “black money”. Black money refers to money obtained through illegal activity and it is used to evade taxes and other regulatory policies. As a part of Modi’s demonetization plan, Modi attempted to directly impact the use of black money in the real estate sector, where an estimated 30% of all transactions are conducted with black money (Thakur, 2015). According to his plan, Modi banned
use of the 500 and 1000 rupee note but allowed individual to make bank deposits to convert the notes into new currency. Although the aim of the demonetization policy was to counteract the use of black money in the real estate sector, this policy has also contributed to the lowering of interest rates (Dasgupta, 2016). In this specific case, we see two factors directly impacting the price of homes. First, the large exodus of black money can possibly cause a sharp correction in real estate prices. Second, the further decrease in interest rates can incentivize more demand in the real estate sector due to the lower cost of borrowing. Hence, in the long-run, Modi’s demonetization plan will have a strong impact on the demand and price of homes in India.

With this recent plan of demonetization, it is important to focus on the development of the property bubble in India. As a rise in home prices will perhaps induce more speculative behavior in the market. On the other hand, a burst of the property bubble will have severe implications for the economic state of India and the global economy.

The investigation of potential bubble forming markets of the emerging economies of China and India demonstrate that the key catalysts of bubbles in emerging economies differ from developed economies. Although the existence of an expansionary monetary policy contributes to the speculative behavior in these markets, China and India experience unique economic conditions, which are simulating the creation of a housing bubble. First, the rapid urbanization of both countries has significantly increased the inflow of FDI. Due to this new investment climate, there is an increased demand for housing in urban areas, but a lack of adequate low-renting housing being developed. Second, the underdeveloped capital markets of China and India facilitate the inflow of
hot money and black money, which has impacted the rise of housing demand. The inflow of hot money and black money in China and India increases housing demand, because this inflow creates a perception of a booming market. The presence of an expansionary monetary policy, rapid urbanization and volatile markets with rising home prices hints at the potential housing bubbles in China and India.
Section VII: Testing for Bubbles

This section aims to construct a model to test for the existence of asset price bubbles in the housing industry of the United States from 1977-2016. We formulate the model based on the theoretical framework of bubble development discussed in section II and the analysis of bubbles conducted in sections III and IV.

7.1: Explanation of Bubble Detection Model

According to the theoretical explanation of bubble formation, the valuation of an asset is not only determined by a market participant’s valuation of an asset based on economic fundamentals, but also is reflective of the market participant’s speculative behavior. The difference between the market price and the economic fundamentals is called a bubble (Flood & Garber, 1980; Li & Chand, 2015; Tirole, 1982). In simple terms, a bubble arises when the valuation of an asset deviates from fundamental value.

In addition to the relationship between bubbles and economic fundamentals, behavioral finance proposes that psychological forces influence investor behavior which contributes to the development of speculative bubbles. As explained before, within the field of behavioral finance, the “positive feedback” approach is a central idea behind the formation of speculative bubbles. An important component of the positive feedback trading is the trend chasing behavior of traders, which is facilitated by their tendency to make trading decisions based on extrapolated trends of past price changes (De Long et al., 1990; Shiller, 2002). If the trend chasing agents’ extrapolated trends are validated by rising fundamentals, agents are likely to transpose their short trend horizons to longer trend horizons and therefore, sustain rising prices and a bubble that is not justified by fundamentals (De Long et al., 1990).
Based on the theoretical explanation of bubble development, it is evident that the two variables of economic fundamentals and past price behavior play a key role in the development of speculative bubbles. Hence, the model constructed to detect the existence of bubbles in the housing industry of the United States from 1977-2016 incorporates these two variables. Equation 1 below presents the model by which the relationship between fundamental indicators and past price changes will be tested to detect bubbles in the U.S. economy:

\[
\% \Delta Price = \% \Delta Fundamentals + \% \Delta Past Prices + error \quad (1)
\]

Economic fundamentals are defined as the discounted future cash flows from an asset based on the rational expectation of that asset’s performance (Li & Chand, 2015; Tirole, 1982). However, the true value of economic fundamentals is difficult to determine due to the uncertainty of two unknown variables—the rational expectation of an asset’s performance and the discount to apply to the future cash flows (Tirole, 1982). Although the true value of economic fundamentals is difficult to determine, economists model the value of economic fundamental through proxy variables.

While researching the relationship between market fundamentals and house price inflation in Beijing, Qiang Li and Satish Chand (2015) regressed housing prices on three proxy market fundamentals—urban disposable income, the number of population and housing vacancy area. As a result of Li and Chand’s research, market fundamentals explained approximately 60% of the observed variation of housing prices in Beijing from 2006 to 2011. Ren, Xiong and Yuan (2012) regressed housing prices on GDP growth rates, unemployment, population growth rate and interest rates to detect bubbles in 35
major cities in China. Ren, Xiong and Yuan (2012) find that there are no rational bubbles in the Chinese housing market.

The market fundamentals employed by the researchers stated above demonstrate a relationship between the proxy fundamental variables and the change of house prices. For example, it is logical to assume that higher interest rates tend to lower housing prices because the cost of borrowing increases. Since the cost of borrowing is higher, home buyers are less likely to demand homes and in turn, this would lower the prices of houses. Therefore, interest rates and housing prices share a negative relationship. Furthermore, many of the market fundamentals used by Li and Chand (2015) and Ren et al. (2012) reflect the regional factors that might influence housing prices such as “population” in China. As shown by these researchers, it is important that market fundamentals capture the regional variables that influence changes in house prices.

The model constructed in this research uses interest rate, inflation rate and the personal income of the states and districts in the U.S. as proxy variables to determine the fundamental value of houses in the U.S. during 1977-2016. By replacing fundamentals with the proxy variables in equation 1, the following model results:

$$\% \Delta Price = \alpha_{it} + \alpha_1 DINT_{it} + \alpha_2 DINF_{it} + \alpha_3 DRHP_{it} + \% \Delta Past Prices + error$$  \hspace{1cm} (2)

As explained before by the positive feedback approach, market agents make trading decisions based on past price changes. In one model of speculative bubbles, Shiller (2002) concludes that demand for assets depends on a distributed lag of past returns. According to this model, demand increases by past returns if the high returns came in the past few months, and demand increases less if the high returns did not come in the past few month. Incorporating this logic within our model, the past price behavior
variable can be described by a distributed lag of five periods [one period=one quarter of a year] as described by equation 3:

\[
\ln \left( \frac{p_{it}}{p_{it-1}} \right) = \alpha_{it} + \alpha_1 DINT_{it} + \alpha_2 DINF_{it} + \alpha_3 DRPI_{it} + \beta_1 \ln \left( \frac{p_{it-1}}{p_{it-2}} \right) + \beta_2 \ln \left( \frac{p_{it-2}}{p_{it-3}} \right) + \beta_3 \ln \left( \frac{p_{it-3}}{p_{it-4}} \right) + \beta_4 \ln \left( \frac{p_{it-4}}{p_{it-5}} \right)
\]

(3)

Using the pooled regression technique, we can test the relationship explained by equation 3. However, to more accurately calculate the percent change between each period, it is important to take the natural log of the distributed lags. By taking the natural log of the %ΔPrice and the components that represent past price change, we can interpret a direct relationship between β_1, β_2, β_3, and β_4 and %ΔPrice. Therefore, the relationship between %ΔPrice and β_1, β_2, β_3, and β_4 can be interpreted as an elasticity.

In equation 3, “α_{it}” represents the percent price change of houses in the initial time period of 1977Q1, while the subscript “it” is the indicative of the state of the variable during a specified period of time. The variable “P” is the quarterly price index of houses in the U.S. from 1977-2016. “DINT” represents the interest rate of the specified quarter and “DINF” is the inflation rate for the stated quarter. The variable “DRPI” is the quarterly personal income of the fifty states and districts in the United States. The “α” coefficients represent the estimators of the fundamental proxy indicators and the “β” coefficient are the estimators of past price changes.

The model described in equation 3 tests the relationship between fundamental values and price changes.
Using the pooled regression technique, the model will evaluate the following null and alternative hypotheses:

\[ H_0: \beta_1 + \beta_2 + \beta_3 + \beta_4 = 0 \]

\[ H_a: \sum \beta > 0 \]

Based on the statistical significance of the exogenous variables defined by the “\( \beta \)” coefficient, the rejection of the null hypothesis will propose that statistical evidence suggests that the price deviation from fundamental values is due to the possible existence of an asset price bubble in United States. Therefore, we will accept the alternative hypothesis as described above. However, if the exogenous variables defined by the “\( \beta \)” coefficient are not statistically significant, then we cannot reject the null hypothesis. Thus, we cannot propose that statistical evidence supports the conclusion that an asset price bubble existed in the United States in the given time period.

7.2: Explanation of Data

The housing data used in this paper are quarterly and cover the time period from 1977 quarter 1 (January-March) to 2016 quarter 4 (October-December) from the United States. Table 1 shows the summary statistics on each of the variables used in the analysis that follows.
TABLE 1: Summary of Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Standard Deviation</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRHP</td>
<td>0.0031</td>
<td>0.7972</td>
<td>-0.5537</td>
<td>0.0306</td>
<td>8160</td>
</tr>
<tr>
<td>DINT</td>
<td>0.0003</td>
<td>0.0161</td>
<td>-0.2150</td>
<td>0.0050</td>
<td>8160</td>
</tr>
<tr>
<td>DINF</td>
<td>-0.0002</td>
<td>0.0073</td>
<td>-0.0110</td>
<td>0.0030</td>
<td>8160</td>
</tr>
<tr>
<td>DRPI</td>
<td>0.0007</td>
<td>0.1579</td>
<td>-0.1575</td>
<td>0.0133</td>
<td>8160</td>
</tr>
<tr>
<td>DRHP1</td>
<td>0.0030</td>
<td>0.7972</td>
<td>-0.5537</td>
<td>0.0309</td>
<td>8160</td>
</tr>
<tr>
<td>DRHP2</td>
<td>0.0030</td>
<td>0.7972</td>
<td>-0.5537</td>
<td>0.0314</td>
<td>8160</td>
</tr>
<tr>
<td>DRHP3</td>
<td>0.0031</td>
<td>0.7972</td>
<td>-0.5537</td>
<td>0.0317</td>
<td>8160</td>
</tr>
<tr>
<td>DRHP4</td>
<td>0.0031</td>
<td>0.7972</td>
<td>-0.5537</td>
<td>0.0320</td>
<td>8160</td>
</tr>
</tbody>
</table>

**DINT** is the change in real 30-year fixed mortgage rate in the U.S., computed as the three-month average of weekly data. The data are compiled by the St. Louis Federal Reserve Economic Databank. It is one of the largest institutions in the U.S responsible for advising the Bank President on matters of economic policy (Freddie Mac, 2016).

**DINF** is the change in quarterly national inflation rate. The quarterly inflation rate is calculated by computing the Gross Domestic Product (GDP) deflator using the following formula:

$$\pi = \ln(GDP\ Deflator_t) - \ln(GDP\ Deflator_{t-4})$$

The GDP deflator is computed using the nominal and real value of GDP, which is gathered by the Bureau of Economic Analysis (2016).
**DRPI** is the change in real quarterly personal income of the fifty states in the U.S. The information regarding this data is collected by the Bureau of Economic Analysis (2016).

**DRHP1, DRHP2, DRHP3,** and **DRHP4** are the lagged distribution variables of the change in the real quarterly price index of houses. The base date is the first quarter of 1980, when the index is set to 100. **DRHP** represents the real percent price change between the current time period and the previous quarter. The quarterly price index of houses is collected from the website of the Federal Housing Finance Agency (2016).

Overall, this data can be best described as pooled cross section data, because the sample is collected randomly from a large population independently of each other at different points in time.

7.3: Results

Rather than using a simple regression technique, this study utilizes pooled regression with fixed effects to capture the relationship between the explanatory variables and the present price change. Per definition, the fixed effects model is useful while dealing with pooled cross section data because it fixes all unobserved, time-constant factors that affect present price change overtime. By regressing **DRHP** on **DINT, DINF, DRPI, DRHP1, DRHP2, DRHP3,** and **DRHP4,** we can observe the results presented in Table 2 below:
**TABLE 2: Pool Regression Output**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Estimated Coefficient</th>
<th>Standard Error</th>
<th>T Ratio (8102 DF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DINT</td>
<td>-0.63361</td>
<td>0.06696</td>
<td>-9.46</td>
</tr>
<tr>
<td>DINF</td>
<td>-0.17858</td>
<td>0.11161</td>
<td>1.60</td>
</tr>
<tr>
<td>DRPI</td>
<td>0.23366</td>
<td>0.02500</td>
<td>9.35</td>
</tr>
<tr>
<td>DRHP1</td>
<td>-0.16607</td>
<td>0.01083</td>
<td>-15.34</td>
</tr>
<tr>
<td>DRHP2</td>
<td>0.09758</td>
<td>0.01696</td>
<td>9.12</td>
</tr>
<tr>
<td>DRHP3</td>
<td>0.15653</td>
<td>0.01063</td>
<td>14.73</td>
</tr>
<tr>
<td>DRHP4</td>
<td>0.15430</td>
<td>0.01025</td>
<td>14.69</td>
</tr>
</tbody>
</table>

**R² = 0.0962**

The R² value reported above indicates the percentage of the variance in the dependent variable that is explained by the model being tested. In this specific case, 9.62% of the variance in present price change (DRHP) is being explained by the estimated model.

Additionally, in terms of the proxy fundamental variables in the model, it is predicted by the model that real interest rates and real personal income are statistically significant explanatory variables in determining the present price change in the U.S. housing market. According to the model, all other factors being constant, an increase of 1% in real interest rates will decrease the present price change by 0.37%. Also, an increase of 1% in personal income will increase the present price change by 1.23%. These results are complementary to economic theory, which suggests that an increase in interest rates will decrease housing demand and house prices due to the high cost of borrowing. Also, economic theory supports the idea that an increase in personal income should increase housing demand and in turn, increase house prices because of the larger availability of wealth (Li & Chand, 2015; Ren, Xiang & Yuan, 2012). This model also suggests that DRHP1, DRHP2, DRHP3 and DRHP4 are statistically significant explanatory variables.
in the model. That is, an increase in DRHP1 by 1% causes present price change to
decrease by .83%. On the hand, an increase in DRHP2 by 1% prompts a positive change
in present price change by 1.10%. Similarly, an increase in DRHP3 by 1% will increase
present price change by 1.16%. Also, an increase in DRHP4 by 1% will increase present
price change by 1.15%. As a result, this model suggests that the overall relationship
between present price change and past price behavior is positive. Overall, due to this
model, we can predict that present price change is influenced by both fundamentals and
past price behavior.

However, this model also reveals that the fundamental indicator of “DINF” is not
statistically different than zero. Although a negative relationship between DINF and
present price change is understandable because higher inflation results in higher real
interest rates which increases the cost of borrowing, the model suggests that inflation is
not a statistically significant determinant of present price changes. However, these results
assets depends on a distributed lag of past returns. Demand increases by past returns if
the high return came in the past few months, and demand increases less if the high returns
did not come in the past few months. The model presented in Table 2 suggests that all
variables that describe past price changes are statistically significant in explaining the
variation in present price change.

We also tested the isolated significance of fundamentals and past price behavior
on present price changes. Using the F-test, the following two set of null and alternative
hypotheses were tested:
Hypothesis Set 1

\[ H_0: DINT = DINF = DRPI = 0 \]

\[ H_a: DINT \neq 0; DINF \neq 0; DRPI \neq 0 \]

Hypothesis Set 2

\[ H_0: DRHP1 = DRHP2 = DRHP3 = DRHP4 = 0 \]

\[ H_a: DRHP1 \neq 0; DRHP2 \neq 0; DRHP3 \neq 0; DRHP4 \neq 0 \]

The null hypothesis in hypothesis set 1 tests whether the fundamental indicators in the model are statistically different than zero. By rejecting the null hypothesis, we will be able to conclude that statistical evidence supports the argument that inflation, interest rates and personal income are significant variables in determining the present price change. In hypothesis set 2, the null hypothesis evaluates whether past price behavior is a statistically significant component in explaining the variation in present price change. A rejection of the null hypothesis will support the conclusion that past price changes are statistically different than zero and are significant explanatory variables in explaining the variation in present price change. By testing these null hypotheses using a F-test, the following results are obtained:

<table>
<thead>
<tr>
<th>TABLE 3: F-Test Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis Set 1 Results:</td>
</tr>
<tr>
<td>F-statistic</td>
</tr>
<tr>
<td>Hypothesis Set 2 Results:</td>
</tr>
<tr>
<td>F-statistic</td>
</tr>
</tbody>
</table>

As indicated by the results in Table 3, both the F-statistic very strongly reject the null hypotheses in sets 1 and 2. A rejection of the null hypotheses supports the claim that present price change is influenced by fundamentals and past price behavior. These results
to some extent help resolve the previous raised concerns as they suggest that another factor is impacting the significance of inflation in the model. Since statistical evidence supports the claim that both past price behavior and fundamentals influence the fluctuation of present price change, another question that arises is which component has a greater impact on present price change?

In order to evaluate this question, we also test the following hypothesis:

\[ H_0: DRHP1 + DRHP2 + DRHP3 + DRHP4 = 1 \]

Based on the results of this test, we will be able to state by what percentage fundamentals and past price behavior influence present price change. By testing the null hypothesis stated above using a F-test, the following results are observed:

| TABLE 4: Determining the Influence of Fundamentals and Past Price Behavior |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Test Value                  | STD. Error of Test Value    | T-Statistic                 | F-Statistic                 | P-Value                     |
| -0.376                      | 0.0161                      | -23.307                     | 543.226                     | 0.000                       |

As demonstrated by the results in Table 4, past price behavior accounts for 62.4% of the variation in present price change, whereas fundamentals account for 37.6% of the fluctuation in present price change. While the results of this test imply that both past price behavior and fundamentals impact the variation of present price change, past price behavior has a stronger impact on the variation of present price change.

Due to these results, we can conclude that the valuation of assets in the U.S. housing market from 1977-2016 were primarily based on past price behavior rather than fundamentals. As explained before, a bubble is created when the valuation of an asset deviates from fundamental value (Flood & Garber, 1980; Li & Chand, 2015; Tirole, 1982). In other words, a bubble’s value is primarily composed of speculative behavior
conducted by market participants which can arise due to past price behavior (De Long, Shleifer, Summers, & Waldmann, 1990; Shiller, 2002). Therefore, based on the definition of bubbles and the results of the statistical analysis presented above, we conclude that the U.S. housing market from 1977-2016 fueled a bubble economy. As we evaluated this conclusion based on historical evidence, this model is validated by the fact that the United States experienced a housing bubble in the early 2000s which led to the Global Financial Crisis.
Section VIII: Conclusion

As the study of these historical speculative bubbles have shown, bubbles are primarily driven by the speculative actions of market participants. It is the speculative behavior of market participants that causes the development of bubbles. However, the rise of speculative behavior in each market is triggered by varying market conditions. The investigation of the historical bubbles has provided contextual clues to the actual creation and propagation of asset bubbles. While the study of historical bubbles in developed economies shows that an expansionary monetary policy, lax financial and commercial regulations, New Financial Architecture and risky financial innovations are the key catalysts of speculative bubbles, these catalysts are not entirely true for emerging economies.

This paper finds that the emerging economies of China and India maybe facing a potential housing bubble in their respective economies. Although the presence of an expansionary monetary policy contributes to the speculative behavior in these markets, China and India face unique conditions which are stimulating the creation of a housing bubble. First, the rapid urbanization of both countries has significantly increased the inflow of FDI. As a result, there is a new-found demand for housing in urban areas, but a lack of adequate low-renting homes being developed. Second, the underdeveloped capital markets of China and India facilitate the inflow of hot money and black money in the market, which creates a false perception of a booming market. In reality, the inflow of hot money and black money creates volatility in the market, because an outflow of hot money and black money will cause the market to crash as market participants will exit the market due to the lack of appropriate returns. The presence of an expansionary
monetary policy, rapid urbanization and volatile markets with rising home prices hints at the potential housing bubbles in China and India. If adequate measures are not taken by both countries to control the exponentially rising home prices, then the burst of another housing bubble will have severe implications for the global economy.

Lastly, we modeled the housing market of the U.S. from 1977-2016 to identify a bubble economy during this time period. This model tested the relationship between present price changes, proxy fundamental indicators and past price changes. Based on the results of the pooled regression and F-tests, it was concluded that past price changes accounted for 62.4% of the variation in the present price change of homes in the U.S. With the support of theoretical and statistical evidence, the results of this paper suggest that the U.S. housing prices between 1977-2016 deviate from fundamental value and are based on the speculative behavior of market participants.

Adding to existing literature, this paper provides statistical and theoretical evidence to show that the past price behavior of market participants is another catalyst which contributes to the development of speculative asset price bubbles. While extensive research has been conducted to understand the creation and propagation of speculative bubbles in developed economies, literature still needs to perform detailed studies on the development of bubbles in emerging economies. Future research can test the presence of past price behavior in the emerging economies of China and India to evaluate whether this indicator plays a role in the formation of the present housing bubble. Based on the analysis of this paper, future research will be able to contribute to the understanding of catalysts and drivers that propagate the development of the speculative asset bubbles in
emerging economies. In our globalized economy, this research will be significant because economic turmoil in one country can have serious repercussion in another.


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