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Quicksilver Markets

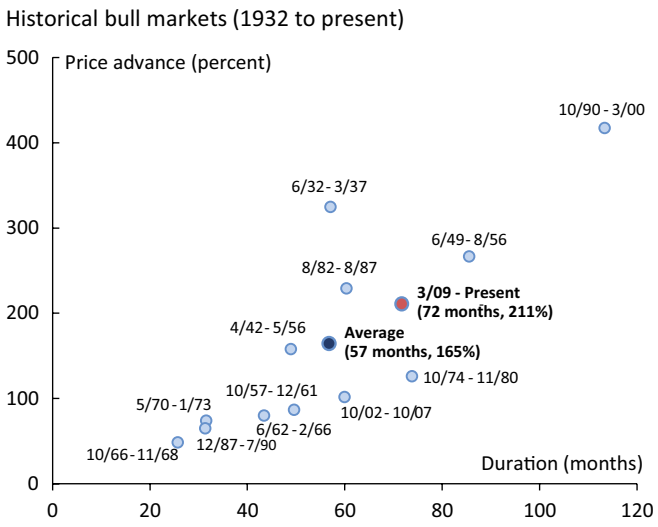
by Ted Berg

One of the missions of the Office of Financial Research is to analyze asset market valuations and if there are excesses, explore the potential financial stability ramifications of a sharp correction. The author argues that U.S. stock prices today appear high by historical standards. Although he notes that the financial stability implications of a market correction could be moderate due to limited liquidity transformation in equity markets, he addresses other financial stability issues that may be more relevant, such as leverage, compressed pricing of risk, interconnectedness, and complexity.

Option-implied volatility is quite low today, but markets can change rapidly and unpredictably, a phenomenon described here as "quicksilver markets." The volatility spikes in late 2014 and early 2015 may foreshadow more turbulent times ahead. Although no one can predict the timing of market shocks, we can identify periods when asset prices appear abnormally high, and we can address the potential implications for financial stability.

The bull market achieved an important milestone in March: its six-year anniversary. From the market bottom in March 2009 through the end of 2014, U.S. equity prices tripled. This gain has been largely driven by the recovery in corporate earnings, which have increased by a similar magnitude over this period. Although the positive trend could continue, the upturn has persisted much longer and prices have risen much higher than most historical bull markets, despite a weaker-than-normal macroeconomic recovery (see **Figure 1**).

Figure 1. Current Bull Market Is Longer and Larger than Historical Bull Markets



Sources: S&P Dow Jones Indices, Byron Wien (Blackstone), OFR analysis

Sources: Bloomberg L.P., OFR analysis

This bull market has also benefited from unusually low interest rates. Some argue that the market's price-to-earnings (PE) ratio is justifiably higher than the historical average given that interest rates are at historic lows. After all, the intrinsic value of a stock is the present value of its discounted future cash flows. And interest rates are a key factor in determining the discount rate. The lower the discount rate, the higher a stock's present value. However, the relationship between interest rates and stock prices is more complex; a lower interest rate environment may portend a lower long-term growth rate for corporate earnings and cash flows. When estimating intrinsic value, it is naïve to simply reduce the estimated discount rate without also considering the potential adverse consequences for the growth rate of cash flows.

Many expect the Federal Reserve to begin increasing short-term rates later this year. This will have important implications for stock prices if longer-term rates begin to increase as well. Under one scenario, a slow and gradual increase in long-term rates would be bullish, reflecting investors' positive expectations for higher U.S. economic and corporate earnings growth. In an alternative scenario, however, interest rates would increase dramatically and unexpectedly, which would adversely affect stock prices.

In light of this interest rate backdrop, the question is whether stock prices have run too far ahead of fundamentals. Although certain traditional valuation metrics, such as the market's forward PE ratio, do not appear alarmingly high relative to historical averages, other metrics to be discussed — the cyclically adjusted PE ratio ("CAPE"), the Q-ratio, and the Buffett Indicator — are nearing extreme levels, defined as two standard deviations (or two-sigma) above historical means.[1]

Historically, periods of extreme valuations are eventually followed by large market price declines, some of which have contributed to systemic crises. On the other hand, extreme valuations have been known to persist for extended periods. For example, in a December 1996 speech, former Federal Reserve Chairman Alan Greenspan famously used the phrase "irrational exuberance" to describe investor enthusiasm for stocks. At that time, the forward PE ratio — the ratio of the market price to analysts' consensus earnings forecasts for the next 12 months — was approximately 16 times. Although this was above the historical average, it was not alarmingly high. However, the CAPE ratio was much higher at 28 times. The S&P 500 more than doubled over the next three years, with valuations reaching all-time highs in March 2000, driven by the boom in technology stocks. The tech bubble eventually burst; the S&P 500 index decreased almost 50 percent and the tech-heavy Nasdaq index dropped nearly 80 percent from peak to trough.

Some Valuation Metrics Are Nearing Extreme Highs

Today, equity valuations appear reasonable based on commonly used metrics such as the forward PE, price-to-book, and price-to-cash flow ratios.[2] But these metrics do not tell the whole story.

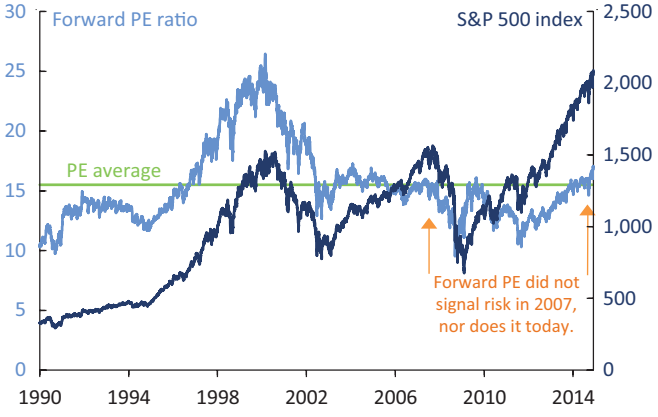
Take, for example, the simple PE ratio, which is a quick and easy way to evaluate stock prices (see **Figure 2**). It's a convention that emerged mostly as a result of "tradition and convenience rather than logic," according to Robert Shiller.[3] Forward PE ratios are potentially misleading for several reasons. First, forward one-year earnings are derived from equity analyst projections, which tend to have an upward bias.[4] During boom periods, analysts often project high levels of earnings far into the future. As a result, forward PE ratios often appear cheap. Second, one-year earnings are highly volatile and may not necessarily reflect a company's sustainable earnings capacity. Third, profit margins typically revert toward a longer-term average over a business cycle. The risk of mean reversion is particularly relevant today, because profit margins are at historic highs and analysts forecast this trend to continue.

Other fundamental valuation metrics tell a different story than the forward PE. This brief focuses on a few — the CAPE ratio, the Q-ratio, and the Buffett Indicator — that are approaching two-standard deviation (two-sigma) thresholds.

Why is two-sigma relevant? Valuations approached or surpassed two-sigma in each major stock market bubble of the past century. And the bursting of asset bubbles has at times had important implications for financial stability. The two-sigma threshold is useful for identifying these extreme valuation outliers. Assuming a normal distribution in a time series, two-sigma events should occur once every 40-plus years; in equity markets, they occur more frequently due to fat-tail distributions.[5]

Figure 2. Forward PE Ratio Does Not Imply Valuation Risk

Forward price-to-earnings (PE) ratio vs. S&P 500 price



Sources: Bloomberg L.P.,OFR analysis

CAPE Ratio. If one-year earnings assumptions based on peak profit margins are potentially misleading, then it seems logical to consider valuation metrics based on normalized (long-run average) profit margins. In 1934, Graham and Dodd argued average earnings should cover a period of at least 5 years, and preferably 7 to 10 years, on the basis that current earnings rarely reflect a company's sustainable earnings capacity.[6] They noted that longer periods are "useful for ironing out the frequent ups and downs of the business cycle" and provide a better measure of a company's earnings power than a single year. Shiller enhanced this concept with CAPE (see **Figure 3**), which is the ratio of the S&P 500 index to trailing 10-year average earnings (earnings are based on generally accepted accounting principles, or GAAP, and are inflation-adjusted). Although CAPE's 10-year timeframe is somewhat arbitrary, it captures earnings over one or two business cycles rather than over a single year, better reflecting sustainable earnings.

The historical CAPE average based on a 133-year data series is approximately 17 times, and its two-standard-deviation upper band is 30 times. The highest market peaks (1929, 1999, and 2007) either surpassed or approached this two-sigma level (1999 exceeded four sigma). Each of these peaks was followed by a sharp decline in stock prices and adverse consequences for the real economy. At the end of 2014, the CAPE ratio (27 times) was in the 94th percentile of historical observations and was approaching its two-sigma threshold.

Q-Ratio. The Q-ratio, defined here as the market value of nonfinancial corporate equities outstanding divided by net worth, suggests a similar message of equity valuations approaching critical levels (see **Figure 4**).[7] Instead of using a traditional accounting-based (historical cost) measure of net worth, the Q-ratio incorporates market value and replacement cost estimates. The Q-ratio also includes a much broader universe of nonfinancial companies (private and public) than CAPE.

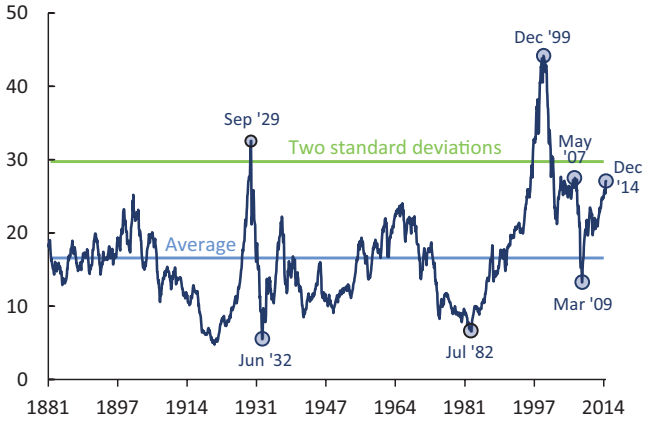
Buffett Indicator. The ratio of corporate market value to gross national product (GNP) is at its highest level since 2000 and approaching the two-sigma threshold (see **Figure 5**).[8] This indicator is informally referred to as the Buffett Indicator, because it is reportedly Berkshire Hathaway Chairman Warren Buffett's preferred measure to assess overall market valuation.[9] Historically, this indicator's message is consistent with CAPE, particularly in identifying periods of extreme valuation before the Great Recession and the 1990s technology stock bubble.

Caveats. The CAPE ratio, Q-ratio, and the Buffett Indicator metrics come with caveats: Changes in accounting standards, corporate taxation policies, and inflation measurement methodologies complicate the comparability of data over long timeframes. As a result, an average based on a long time period may have less relevance today.

Some also argue that the CAPE ratio, which uses GAAP earnings, sends too bearish a message because it is inflated by record low earnings caused by large write-offs during the financial

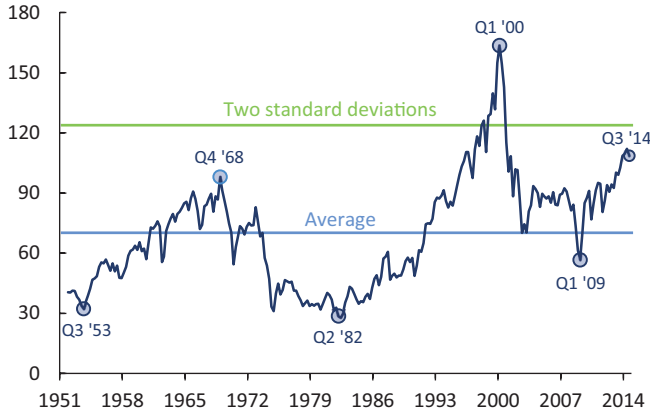
CAPE, Q-Ratio, and Buffett Indicator are Approaching Two-Sigma Thresholds

Figure 3. CAPE ratio



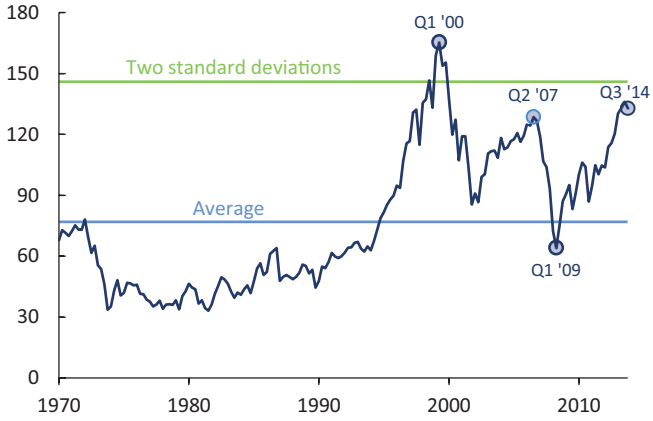
Note: CAPE is the ratio of the monthly S&P 500 price level to trailing 10-year average earnings (inflation adjusted).
Sources: Robert Shiller, OFR analysis

Figure 4. Q-ratio (percent)



Note: Q-ratio is the market value of nonfinancial corporate equities outstanding divided by net worth at market value.
Sources: Federal Reserve, OFR analysis

Figure 5. Ratio of corporate market value to GNP (percent)



Note: This is the market value of corporate equities (Wilshire 5000 market capitalization) divided by nominal GNP.
Sources: Haver Analytics, Wilshire Associates, OFR analysis

crisis.[10] The primary argument for excluding those charges from the analysis is that they are assumed to be nonrecurring and not reflective of future earnings potential, which may be true to an extent. But generally speaking, write-offs and "special" charges (or one-time items) often recur in one form or another. These items extract real value from long-term shareholders and are relevant when analyzing earnings over multiple business cycles. Another counterargument to CAPE's critics is that earnings for many companies were overstated leading up to the last crisis; so later write-offs simply corrected for the overstatement. Finally, despite the inclusion of write-offs in GAAP earnings, it is interesting to note that CAPE's trailing 10-year average earnings are well above, not below, the historical trend (see **Figure 6**).

Other caveats are worth noting for the Q-ratio and the Buffett Indicator. The Q-ratio excludes financial corporations, such as banks and financial services companies (these entities contributed to excessive valuations in the mid-2000s). The Buffett Indicator has an upward bias because foreign profits of U.S. corporations have increased over time.

However, these caveats do not invalidate the usefulness of these metrics, which each cover long timeframes. Although no two market cycles are exactly the same, history provides important lessons in interpreting trends and outliers. The trade-off of excluding large portions of history because of imperfect data is loss of perspective. In particular, during financial booms, analysts extrapolate record profit margins far into the future, ignoring history and the forces of mean reversion.

Evaluating the Possibility of a Market Correction

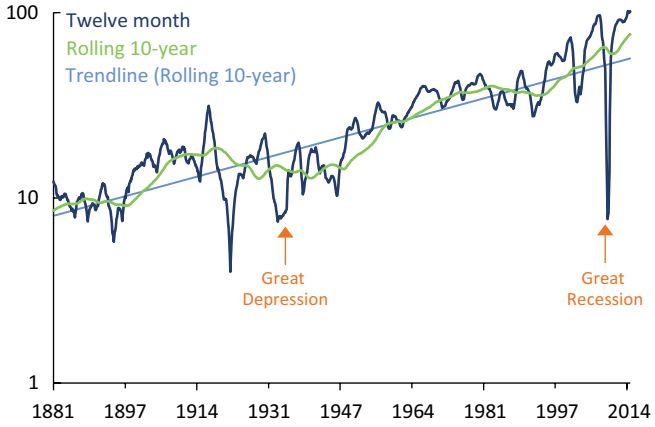
History shows a clear relationship between the CAPE ratio and forward 10-year compounded annual real returns (see **Figure 7**).[11] High valuations today imply lower future returns. However, none of these valuation metrics — the CAPE ratio, the Q-ratio, or the Buffett Indicator — predicts the timing of inflection points, and markets may remain undervalued or overvalued for very long periods. But we can use these metrics as barometers to gauge when valuations are reaching excessively high or low levels.

The timing of market shocks is difficult, if not impossible, to identify in advance, let alone quantify — a shock, by definition, is unexpected. When assessing asset valuation it is important to make a distinction between risk and uncertainty. Risk may be quantified and described in probabilistic terms, and analysts can factor this into their valuation models. However, uncertainty is hard to quantify because it refers to future events that cannot be fully understood or quantified. Today's high stock valuations imply that investors underestimate the potential for uncertain events to occur.

Figure 8 shows the relationship between valuation and future returns more explicitly. Historically, the highest returns follow periods of low valuations (CAPE < 10) and the lowest returns

Figure 6. Earnings Mean Revert Over Time and Are Well Above Trend

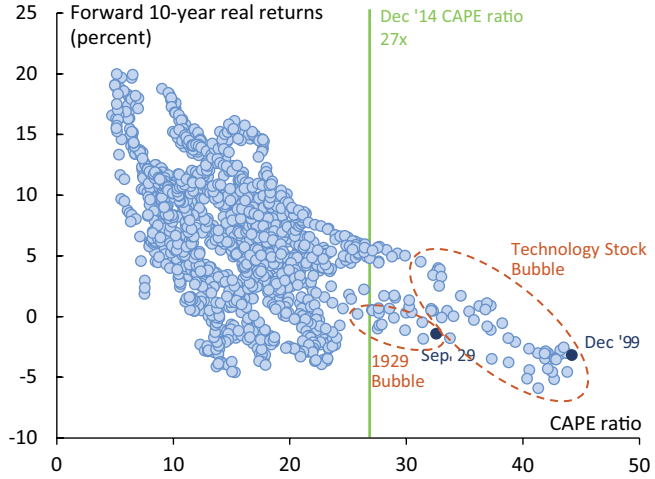
S&P 500 real earnings vs. trend ($ per share, logarithmic scale)



Sources: Robert Shiller, OFR analysis

Figure 7. CAPE Is High Relative to Historical Levels

CAPE ratio vs. forward 10-year real returns (1881-2004)



Sources: Robert Shiller, OFR analysis

follow periods of high valuations (CAPE > 30). When setting expectations for future returns, CAPE appears most relevant at these extreme lows (expect above-average future returns) and highs (expect below-average future returns). In fact, real returns were negative, as shown in Figure 8, when CAPE exceeded the two-sigma threshold. Similar conclusions may be drawn from other metrics, such as the Q-ratio and Buffett Indicator, but the historical time series associated with them are shorter.

To be clear, extreme valuations (2-sigma) are only one characteristic of a potential bubble. Valuation in isolation is not necessarily sufficient to trigger a downturn, let alone pose risks to financial stability. Other factors are relevant for analyzing market cycles — most important, corporate earnings.

Robust growth in corporate earnings is the primary driver behind the stock market's gains over the past several years. But sales growth has been much more modest. Since the cyclical low in 2009, earnings have increased at a double-digit annual growth rate while sales have increased at a more modest mid-single-digit rate. The higher trend growth in earnings versus sales is due to rising profit margins. S&P 500 profit margins reached a record 9.2 percent (trailing 4-quarter, GAAP) in the third quarter of 2014 (see **Figure 9**), well above the historical average of 6.3 percent.

Broader measures of corporate profitability (before and after tax) tell a similar story (see **Figure 10**). The Bureau of Economic Analysis corporate profit data series covers approximately 9,000 companies, public and private, so it is a much broader measure than S&P 500 profits.

To date, record high margins are in part supported by favorable secular trends: a greater proportion of high margin sectors in the S&P 500 composite, lower corporate effective tax rates due to a higher mix of foreign profits, and productivity improvements such as automation and supply chain enhancements. The lower margin, capital-intensive sectors that dominated the market index in earlier decades have given way to more profitable and less capital-intensive sectors due to the computing revolution (early 1980s) and the gradual transition to a services-driven economy. Since the 1970s, lower margin, capital-intensive sectors (industrials, materials, and energy) have fallen from 39 to 22 percent of S&P 500 market capitalization, while higher margin sectors (technology, financials, and health care) have risen from 23 to 50 percent.

Other favorable cyclical factors have also helped to boost profitability, including low interest rates, low labor costs, cost-cutting initiatives, and positive operating leverage (high fixed costs relative to variable costs). However, many of these are not sustainable. Current historically low interest rates will eventually rise. Labor costs will increase as unemployment decreases, and cost-cutting initiatives, such as underinvestment in research and development and capital spending (key sources of future revenue growth), cannot continue indefinitely. Finally, positive operating leverage works in reverse when the sales cycle turns.

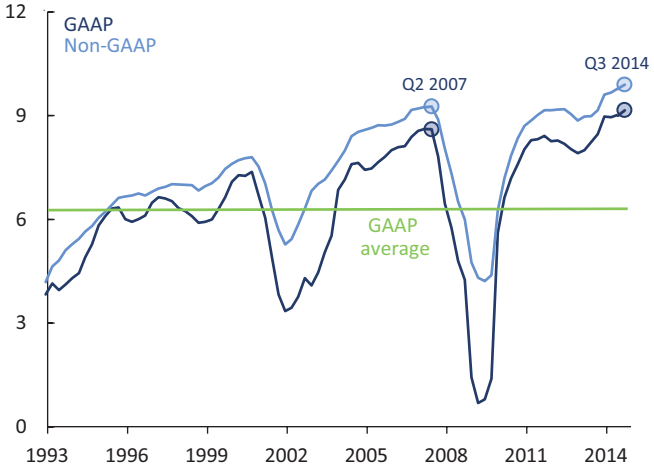
Figure 8. High CAPE Implies Low Future Returns[12]

CAPE	Annualized Total Returns Per Year Over Subsequent 10-Year Period					
	Nominal (percent)			Real (percent)		
	Median	High	Low	Median	High	Low
5-10x	15.2	21.1	-0.2	11.0	20.0	1.8
10-15x	11.7	19.8	2.7	7.7	17.6	-4.1
15-20x	8.0	19.3	-0.4	6.1	16.1	-4.6
20-25x	6.0	11.7	-2.6	3.9	9.0	-4.0
25-30x	7.5	9.2	-3.4	4.9	6.5	-1.2
> 30x	1.2	7.3	-4.0	-1.1	4.5	-5.9

Source: OFR analysis

Figure 9. Profit Margins Are at Record Highs

S&P 500 profit margin (percent, trailing 4-quarter)



Sources: S&P Dow Jones Indices, OFR analysis

Of course, the current cycle could continue as long as revenue growth offsets these margin pressures.

Taking a longer-term view, beyond a single cycle, competitive market forces are another key factor that limits future margin expansion. Profitable industries eventually attract new capital and new competitors, ultimately reducing margins over time in mature industries. This is particularly true in a highly competitive global economy.

Mean reversion in margins has important implications for equity valuations. The current forward PE ratio appears reasonable only if record margins are sustained. During business cycle peaks, when margins are high, investors often fail to factor margin mean reversion into earnings estimates and then adjust forward PEs lower to compensate for this risk.

Financial Stability Implications

Extreme asset valuations can have implications for financial stability. Although the bursting of the technology stock bubble in the early 2000s did not disrupt the functioning of financial markets, the other two major crashes of the past century, following the 1929 and 2007 peaks, contributed to widespread financial instability.

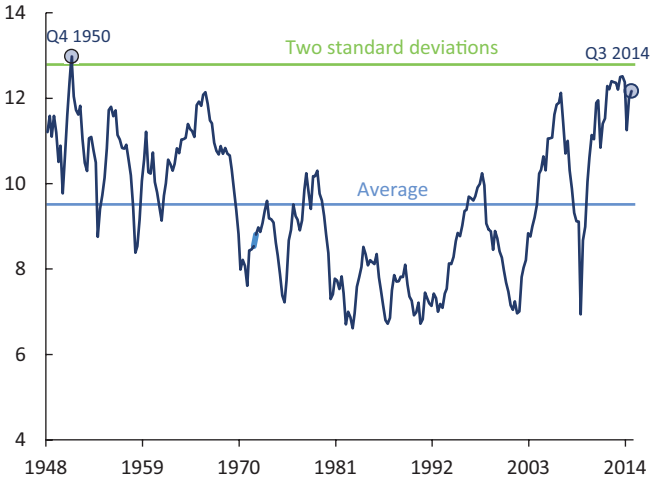
Broadly speaking, systemic crises tend to be preceded by bubbles in one asset class or another. Brunnermeier and Schnabel identified four factors that accelerate the emergence of asset bubbles: expansive monetary policy, lending booms, foreign capital inflows, and financial deregulation.[13] They concluded that the financing of bubbles is much more relevant than the type of asset bubble, noting that "bubbles in stocks may be just as dangerous as bubbles in real estate if financing runs through the financial system." They also noted that the spillover effects of bubbles bursting are most severe when accompanied by a lending boom, high leverage, and liquidity mismatch of market players.

Adrian, Covitz, and Liang defined systemic risk as the potential for widespread financial externalities, whether from corrections in asset valuations, asset fire sales, or other forms of contagion, to amplify financial shocks and, in extreme cases, disrupt financial intermediation.[14] They noted that systemic risks may arise from vulnerabilities such as leverage, maturity and liquidity transformation, compressed pricing of risk, interconnectedness, and complexity. For these reasons, it is important for regulators to consider potential systemic risk implications when asset prices approach extremes.

The U.S. stock market may pose fewer financial stability risks because liquidity transformation is less relevant compared to other financial markets, such as certain fixed-income markets. However, other vulnerabilities that may amplify shocks could be more relevant to assessing financial stability risks. These include leverage, compressed pricing of risk, interconnectedness, and complexity.

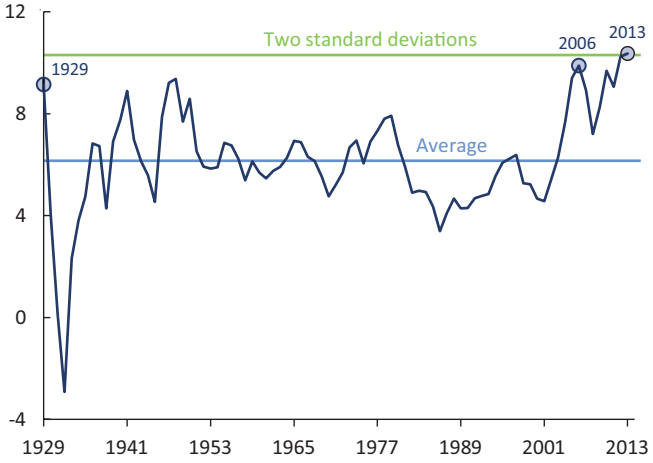
Figure 10. Broader Measures of Profits Are High

Corporate profits before tax divided by nominal GNP (percent)



Sources: Bureau of Economic Analysis, OFR analysis

Corporate profits after tax divided by nominal GNP (percent)



Sources: Bureau of Economic Analysis, OFR analysis

Leverage. Leverage can magnify the impact of asset price movements. Leverage achieved through stock margin borrowing played an important role in inflating stock prices in the 1929 stock market bubble and to a lesser extent in the late 1990s technology stock bubble. Margin debt, according to the Financial Industry Regulatory Authority, reached a record $500 billion at the end of the third quarter of 2014, representing just over 2 percent of overall market capitalization. Although this percentage is below the peak in 2008, it is higher than historical levels (see **Figure 11**). The percentage does not appear alarmingly high, but forced sales of equities by large leveraged investors at the margin could be a catalyst that sparks a larger selloff. Other forms of leverage, such as securities lending and synthetic leverage achieved through derivatives, may also present risks.

Another component of leverage in the system is the financing activities of corporations. Today, high profits have made corporate balance sheets generally quite healthy. As of the third quarter of 2014, U.S. nonfinancial corporations held a near-record $1.8 trillion in liquid assets (cash and financial assets readily convertible to cash). However, corporations also have racked up a record amount of debt since the last crisis.

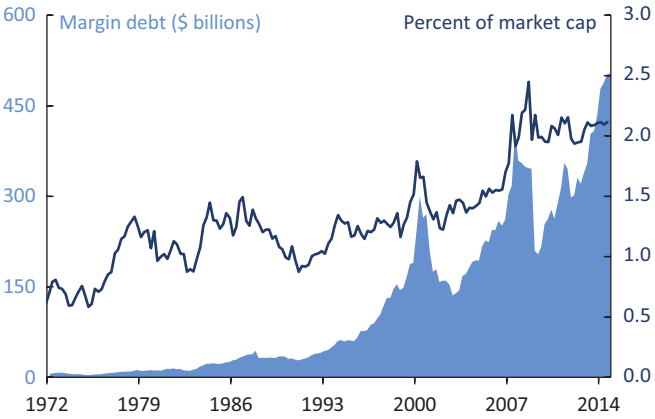
U.S. nonfinancial corporate debt outstanding has risen to $7.4 trillion, up from $5.7 trillion in 2006. Proceeds from debt offerings have largely been used for stock buybacks, dividend increases, and mergers and acquisitions. Although this financial engineering has contributed to higher stock prices in the short run, it detracts from opportunities to invest capital to support longer-term organic growth. Credit conditions remain favorable today because of the positive trend in earnings, but once the cycle turns from expansion to downturn, the buildup of past excesses will eventually lead to future defaults and losses.[15] If interest rates suddenly increase, then financial engineering activities will subside, removing a key catalyst of higher stock prices.

Compressed Pricing of Risk. Asset prices based on compressed risk pricing are prone to drop, and severe drops may pose a risk to financial stability. Today's high valuation multiples imply that investors are willing to accept a much lower risk premium (and weaker than average stock returns) in the future. The equity risk premium (ERP), which reflects the additional return an investor expects to receive over risk-free assets, such as U.S. Treasuries, is an important component of asset valuation models (it is a key part of the discount rate used to calculate the present value of future cash flows). The market's historical ERP has averaged 4.5 percent since 1900, but this premium itself is a random variable that changes over time as investor expectations change.[16] As a result, the historical ERP offers only limited insight into the future (implied) ERP.[17] As stock prices appreciate materially during the latter stages of a bull market phase, risk pricing is compressed and implied ERPs decrease, leaving investors with little margin of safety.

Interconnectedness. The U.S. equity market is highly interconnected with other financial markets, such as equity options

Figure 11. Margin Debt Is at a Record High

Margin debt ($ billions and percent)



Note: Market capitalization refers to the Wilshire 5000 index.
Sources: FINRA, Wilshire Associates, OFR analysis

and futures markets and global equity markets, making it possible for weakening financial conditions to propagate rapidly from one financial market to another. The larger the market, the more pronounced the feedback loops. And the U.S. equity market (excluding options and futures) is large at more than $24 trillion in market capitalization.

The equity market is also interconnected with the real economy. Equity markets play an important role in capital formation for corporations that seek to access funds through stock offerings. In addition, U.S. households and stock markets are interlinked — 49 percent of families directly or indirectly own stocks.[18] Given these interconnections, when asset bubbles burst they can adversely impact corporate and consumer spending; these negative consequences are typically long-lasting. Reinhart and Rogoff analyzed systemic financial crises in several developed and developing economies and found that crises sparked by asset market collapses (generally following extreme asset price levels) were deep and prolonged.[19]

Complexity. The underlying plumbing, or market microstructure, of the equity market is highly complex, and that complexity may pose a risk to core market functions, such as price discovery and liquidity provisioning.[20] The equity market plumbing usually functions efficiently and effectively. However, complexity could pose a risk to financial stability if an impairment of core functions occurs during a period of broader market stress, such as when an asset bubble bursts. Examples of complexity include automated algorithm-based high-frequency trading and order routing systems. These technologies greatly reduce transactions costs and trade execution speeds, but regulators and market participants have little transparency into how these systems work. The Flash Crash in May 2010 illustrates how market price movements are amplified by aggressive automated-based trading, which can trigger a chain reaction of selling. Complexity is also evident in the decentralized (fragmented) nature of stock trading as equities may trade across a large number of venues, both on- and off-exchange. Market prices may be more sensitive to liquidity shocks in these fragmented markets, resulting in more extreme price changes during periods of stress.

Although overall equity valuations appear high today, the relevance of the financial stability risks noted above may come down to financial sector valuations. Today, valuations for financial stocks appear more reasonable. Financial stability risks are more prominent when valuations are excessively high for both the overall market and the financial sector, due to the important role the latter plays in credit intermediation. Before the last crisis, financial stocks were significantly overvalued and comprised a record 22 percent of the S&P 500's market capitalization in 2006. The subsequent stock market decline contributed to the financial crisis. In contrast, the bursting of the market bubble in 2000, following the technology stock boom of the 1990s, did not pose any financial stability risks; back then, financial stocks represented only 14 percent of the overall market capitalization. As of the end of 2014, this percentage has increased to almost 17 percent, which is moderately above the sector's historical average (15 percent) but not alarmingly high.

Conclusion

Markets can change rapidly and unpredictably. When these changes occur they are sharpest and most damaging when asset valuations are at extreme highs. High valuations have important implications for expected investment returns and, potentially, for financial stability.

Today's market environment is different in many ways from the period preceding the Great Recession, because regulators and market participants have made adjustments to enhance financial stability since the financial crisis. In that time, stock returns have been exceptional and market volatility generally subdued. Today, many market strategists see the bull market extending throughout 2015.

However, quicksilver markets can turn from tranquil to turbulent in short order. It is worth noting that in 2006 volatility was low and companies were generating record profit margins, until the business cycle came to an abrupt halt due to events that many people had not anticipated. Although investor appetite for equities may remain robust in the near term, because of positive equity fundamentals and low yields in other asset classes, history shows high valuations carry inherent risk.

Based on the preliminary analysis presented here, the financial stability implications of a market correction could be moderate due to limited liquidity transformation in the equity market. However, potential financial stability risks arising from leverage, compressed pricing of risk, interconnectedness, and complexity deserve further attention and analysis.

Endnotes

[1] See Jeremy Grantham, "Looking for Bubbles," *GMO Quarterly Letter,* GMO LLC, First Quarter 2014; and "Pavlov's Bulls," *GMO Quarterly Letter,* GMO LLC, Fourth Quarter 2010.

[2] There are a number of ways to assess equity market valuation. This brief is not intended to represent a comprehensive review of all methods.

[3] See Robert J. Shiller, "Price-Earnings Ratios as Forecasters of Returns: The Stock Market Outlook in 1996," online paper, July 21, 1996 (available at www.econ.yale.edu/~shiller/data/peratio.html, accessed January 29, 2015).

[4] Several studies document analyst optimism in earnings forecasts: see Greg Harrison, "Estimates Too High, Low? Check The Calendar," Thomson Reuters, February 11, 2013; Robert H. Ashton and Anna M. Cianci, "Motivational and Cognitive Determinants of Buy-Side and Sell-Side Analyst Earnings Forecasts," *The Journal of Behavioral Finance* 8, no. 1 (2007), 9-19; Stan Beckers, Michael Steliaros, and Alexander Thomson, "Bias in European Analysts' Earnings Forecasts," *Financial Analysts Journal* 60, no. 2 (2004), 74-85; Werner F.M. DeBondt and Richard H. Thaler, "Do Security Analysts Overreact?," *American Economic Review* 80, no. 2 (1990), 52-57; Lawrence D. Brown, "Analyst Forecasting Errors: Additional Evidence," *Financial Analysts Journal* 53, no. 6 (1997), 81-88; and Rafael LaPorta, "Expectations and the Cross-Section of Stock Returns," *The Journal of Finance* 51, no. 5 (1996), 1715-1742.

[5] See Grantham (2014).

[6] See Benjamin Graham and David L. Dodd, *Security Analysis* (New York: McGraw Hill), 1934.

[7] Net worth at market value (denominator of Q-ratio) is derived by subtracting liabilities from assets stated at either market value or replacement cost, as shown in Table B.102 of the Federal Reserve's Financial Accounts of the United States (see www.federalreserve.gov/releases/z1/, accessed February 26, 2015). For more on the Q-ratio, see Andrew Smithers, *Wall Street Revalued* (United Kingdom: John Wiley & Sons Ltd.), 2009.

[8] The historical time series for the ratio of corporate market value-to-GNP is similar to that of the S&P 500 price-to-sales ratio.

[9] See Carol Loomis, "Warren Buffett on the Stock Market," *Fortune,* December 10, 2001.

[10] This same criticism of the CAPE ratio was made in the mid-2000s when it was at a similar level as today. At that time, the ratio included low earnings during the 2001 recession.

[11] Figure 7 shows CAPE ratios from January 1881 through December 2004 and the subsequent 10-year annual return for each CAPE ratio. Ratios after this period are not shown because 10-year returns are not yet determined.

[12] In Figure 8, median refers to the historical return in the 50th percentile of observations. Half of historical returns are greater than and half are less than the median.

[13] See Markus Brunnermeier and Isabel Schnabel, "Bubbles and Central Banks: Historical Perspectives," online paper, July 18, 2014 (available at scholar.princeton.edu/sites/default/files/markus/files/20140718_bubblescentral_banks_0.pdf, accessed January 29, 2015).

[14] See Tobias Adrian, Daniel Covitz, and Nellie Liang, "Financial Stability Monitoring," Federal Reserve Bank of New York Staff Report no. 601, June 2014 (available at www.newyorkfed.org/research/staff_reports/sr601.pdf, accessed February 26, 2015).

[15] See Office of Financial Research (OFR), *2014 Annual Report,* Washington, 20.

[16] See Elroy Dimson, Paul Marsh, Mike Staunton, and Michael Mauboussin, "Credit Suisse Global Investment Returns Yearbook 2014," online report, February 2014 (available at publications.credit-suisse.com/tasks/render/file/?fileID=0E0A3525-EA60-2750-71CE20B5D14A7818, accessed January 29, 2015).

[17] See Clifford Asness, "Fight the Fed Model," *The Journal of Portfolio Management* 30, no. 1 (Fall 2003), 11-24; and Aswath Damodaran, "Equity Risk Premiums (ERP): Determinants, Estimation and Implications," online paper, March 23, 2013 (available at papers.ssrn.com/sol3/papers.cfm?abstract_id=2238064, accessed January 29, 2015).

[18] See Jesse Bricker, Lisa J. Dettling, Alice Henriques, Joanne W. Hsu, Kevin B. Moore, John Sabelhaus, Jeffrey Thompson, and Richard A. Windle, "Changes in U.S. Family Finances from 2010 to 2013: Evidence from the Survey of Consumer Finances," *Federal Reserve Bulletin* 100, no. 4 (September 2014).

[19] See Carmen Reinhart and Kenneth Rogoff, "The Aftermath of Financial Crises," NBER Working Paper 14656, Cambridge, Mass., January 2009 (available at www.nber.org/papers/w14656, accessed February 27, 2015). The authors noted that severe asset market collapses are associated with an average peak-to-trough decline of 35 percent in real housing prices over a six-year period, an average decline of 55 percent in equity prices over three-and-a-half years, an average increase of 7 percentage points in the unemployment rate over four years, and an average increase of 86 percent in government debt since World War II.

[20] See OFR (2014), 38-40.