

**The 5% Canary**  
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**Abstract**

This paper will show that the amount of time taken for the S&P 500 or Dow Jones Industrial Average to decline by 5% from a 52-week high illustrates significant insight to the subsequent trend in price. A study on price history for two major equity indices is conducted to show a relationship between duration of an initial decline and the potential for further material weakness or the opportunity for the index to reverse and move higher. With the examination of an 18<sup>th</sup> century mathematical challenge, a simple lens into the market is shown and evaluated, resulting in a tool that retail and professional investors may apply to markets in the pursuit of capital preservation and appreciation.

Buy the dip or prepare for further decline? That's the question presented to investors throughout each trading year as the equity market ebbs and flows, experiencing periods of volatility and persistent trends. Since 1950, the S&P 500 has spent 90% of the time in some degree of drawdown.<sup>1</sup> The proper management of risk is one of the cornerstones of being a successful investor in the long-term, and to do so, a suitable discipline of buy and sell protocols must be in place. This paper focuses on the initial 5% declines from 52-week highs in the price history for

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<sup>1</sup> Based on closing value of the S&P 500 from January 1<sup>st</sup>, 1950 through September 30, 2022.

the S&P 500 and Dow Jones Industrial Average to determine if the speed at which this decline occurs has predictive value in the ensuing price direction for the equity market. The topic will be divided into two sections: first, the evaluation of the implications of an equity index declining by 5% within a specific period of time; and second, the possible bullish opportunities that may result when these 5% declines occur over a protracted number of trading days. Findings will show that the measure of time it takes the noted equity indices to decline by 5% does have meaningful value in both downside mitigation as well as in upside capture potential.

## Literature Review

### Early Speed

The initial concept of evaluating the possible risks of a market downturn based on the acceleration of the first signs of market weakness stemmed from this author's research on the brachistochrone curve. In 1696, Johann Bernoulli posed a challenge to the math community that sought to discover the shape of the path an object must travel when being pulled by gravity to travel from point A to point B in the least amount of time. While a straight line may be the *shortest* path between two points, Bernoulli's proposed question and the subsequent answer showed it not to be the *quickest*.<sup>2</sup> While it took Bernoulli much longer than Isaac Newton, who

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<sup>2</sup> See Herrera, 1994

anonymously submitted his solution to the challenge, Bernoulli applied the findings of Pierre de Fermat who uncovered the principle of least time based on his work calculating refraction angles and the trajectory light takes when traveling between two points.<sup>2</sup> When working on the solution, Bernoulli recognize the most efficient path used the differential equation for a cycloid, which is simply the arc shape that would be traced if one put a pin or writing instrument in the exact middle of a ball or wheel (any circular object) and rolled it on an level surface.<sup>3</sup> In Figure 1, a depiction of the cycloid-shaped curve of the brachistochrone curve (illustrated by the red line), we can see how the dramatic drop and arc of the curved path allows an object to travel at an initial high rate of speed without sacrificing a significant distance, while an identical object traveling on the course of the straight line moves at a slower pace. This application of a cycloid in a brachistochrone curve has been used in many areas outside of academia, including extreme sports like surfing<sup>4</sup> and skiing.<sup>5</sup> The idea of “early speed” in the movement of an object, as adapted from the brachistochrone curve, will be the primary focus of this paper and its application to the equity market. This concept will be drawn upon to help answer the question of whether the initial amount of time it takes

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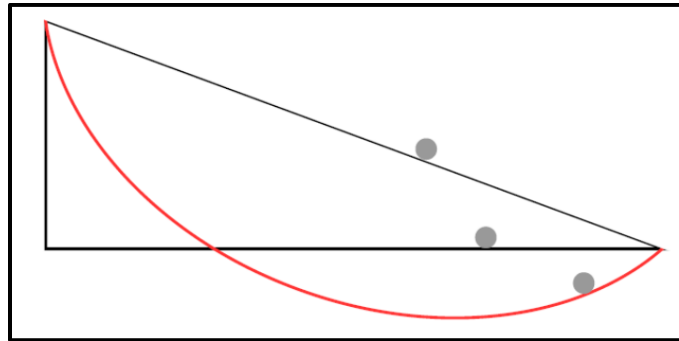
<sup>3</sup> See 3Blue1Brown, 2016

<sup>4</sup> See Henry & Watt, 1998

<sup>5</sup> See Jennings, 2017

price to decline has a relationship with the resulting drawdown experienced by an equity index.

**Figure 1:** The Brachistochrone Curve



*Source: Shi & Celik, 2017*

### Investor Sensitivity to Losses

Evaluating the movement in price activity of the cited indices as they experience early signs of drawdown, an investor must evaluate if action needs to be taken to protect from further declining market prices or if an opportunity is being presented for the index to reverse its decline and begin moving higher. In their paper on Prospect Theory, Kahneman and Tversky showed the experience of loss is twice as great as the pleasure derived from gain.<sup>6</sup> Ultimately this impacts an investor's ability to unemotionally make decisions in regard to avoiding further loss and seeking capital appreciation opportunities.

Because of the overt sensitivity to losses on investors, larger market moves can draw a greater degree of attention as observed by Kaminski and Lo, "in particular,

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<sup>6</sup> See Kahneman & Tversky, 1979

in the event of a significant drop in aggregate stock prices, investors who are generally passive will become motivated to trade because mounting losses will cause them to pay attention when they ordinarily would not.”<sup>7</sup> Kaminski and Lo go on to contend that this increase in attention can enhance the irrationality of market participants and exacerbate the downside market move. This focus on attention-driven behavior also impacts buying decisions to a greater degree for retail investors. Barber and Odean note, “individual investors display attention-driven buying behavior. They are net buyers on high-volume days, following both extremely negative and extremely positive one-day returns, and when stocks are in the news. Attention-driven buying is similar for large capitalization stocks and for small stocks.”<sup>8</sup>

This paper will address this emotionally driven impediment to buying in Section Two, applying a data dependent lens to buying opportunities presented after protracted periods of price weakness. The emotional emphasis on attention-grabbing data and media is also expanded with the increase in available resources to investors. However, there seems to be a stronger reliance on external resources for broad market viewpoints compared to stock-specific opinions. Peng and Xiong argue that investors put a greater degree of focus on broad market and sector-level

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<sup>7</sup> See Kaminski & Lo, 2014

<sup>8</sup> See Barber & Odean, 2008

information inputs than on individual stock-related data points.<sup>9</sup> This goes to the importance of properly evaluating the price movement of the broad equity market indices in a more pragmatic approach.

Not only do investors over-react to large downside market events, but they also expect them to occur more often than history would suggest. A survey of high-net-worth and institutional investors from 1980 to 2004 found that accredited investors placed a 19% probability of a 1929 or October 1987-type of crash occurring again. Instead, from 1925 through 2015 the market has experienced crash-like declines just 1.7% of the time.<sup>10</sup> While periods of major market weakness are not abnormal, they do not occur nearly as often as many investors believe they will. This irrational belief can be corrected by having a methodology for evaluating market declines early on in their potential developing process. The approach that is discussed in this paper is one such method, which may provide enough advance warning to make proper investment decisions to escape the possible pain from losses Kahneman and Tversky have shown investors are so eager to avoid.

### Drawdowns & Market Timing

As previously stated, the S&P 500 has been in some form of decline during 90% of its trading days. While we can only know the final degree of decline after it has occurred, historically most down trends experienced by the S&P 500 have been

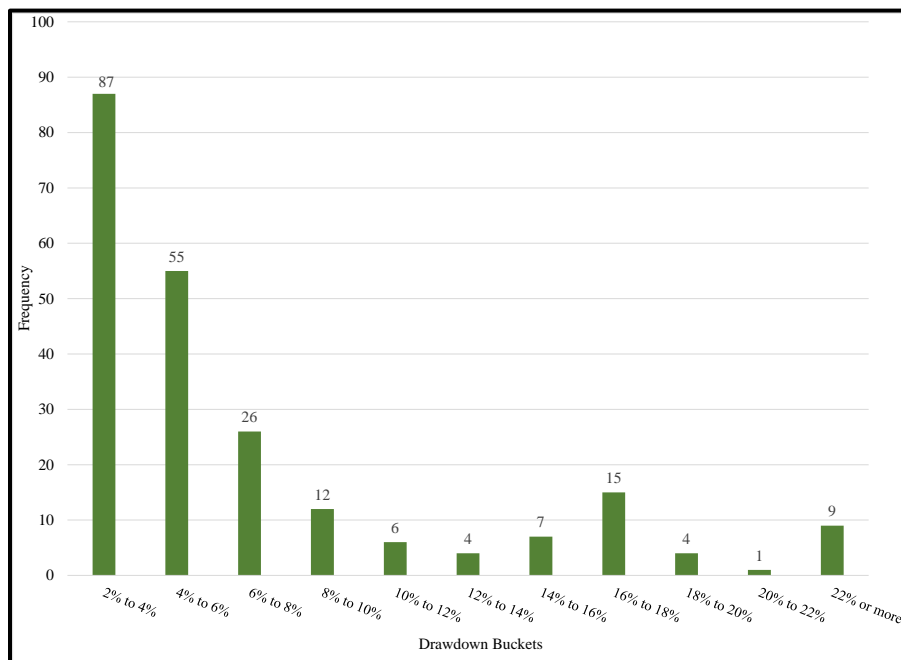
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<sup>9</sup> See Peng & Xiong, 2006

<sup>10</sup> See Goetzmann, Dasol & Shiller, 2016

between 2% and 6%. In Figure 2 we can see that when declines that exceed 2% on a closing basis, 63% of drawdowns in the index are in the noted range.<sup>11</sup> While 2% to 6% may well be within the acceptable risk range for most investors, it's the declines that move into the double-digit category that cause many investors to become uncomfortable and begin to react irrationally. This paper will present a methodology investor can use to evaluate if the more common 5% declines in the S&P 500 and Dow Jones Industrial Average are likely to continue lower and threaten the risk of a more severe drawdown or offer a mean-reversion bullish opportunistic trade.

**Figure 2:** Number of Declines By Percentage Group in the S&P 500



*Percentage declines in price for the S&P 500 based on closing values from January 1950 to September 2022 grouped into eleven buckets. Declines less than 2% were excluded for scaling purposes.*

<sup>11</sup> During the evaluated period, 609 declines of less than 2% occurred and are outside the scope of focus for this paper.

The practice of market timing often involves the use of technical analysis – using the data provided by changes in price and volume to make investment decisions in the active pursuit of capital appreciation and/or capital preservation. Market timing is often viewed as the third rail of the financial industry, drawing strong views from both adamant supporters and hardened critics. One of the most common arguments against market timing is the belief that potentially missing the strongest days of market performance will have a larger cost to the investor than what could be gained by avoiding the largest declines. This belief was disproven in Antoons (2016) with a review of market history from 1961 through 2015, which found the annualized return for missing the 25 best days in the S&P 500 to be 5.74% and avoiding the worst 25 days produced a return of 15.27%. However, if an investor were to miss both the best and worst days, Antoons notes the annualized return would have been 10.94%, still exceeding that of a buy and hold investor of 9.87%.<sup>12</sup>

The perception that markets are entirely random has also been shown to not be accurate.<sup>13</sup> If there is fruit to be harvested by active involvement in financial markets through the use of timing opportune and inopportune periods of investment, then certain methods are likely to be shown to be more qualified than others. Through the extensive testing of tools and lookback periods, technical

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<sup>12</sup> See Antoons, 2016

<sup>13</sup> See Lo & MacKinlay, 1988



analysis has been shown to be an appropriate form of market research. Brock, Lakonishok and LeBaron conducted a review of market data from 1897 to 1986, using price history of the Dow Jones Industrial Average. They tested trading signals generated from various moving averages and trading range breakouts, concluding that “overall, our results provide strong support for the technical strategies that we explored. the returns obtained from buy (sell) signals are not likely to be generated by the four popular null models. Consistently, buy (sell) signals generate returns which are higher (or lower) than "normal" returns.”<sup>14</sup>

### **Section One: The Canary Decline**

Shown in Figure 2, the majority of the substantive declines experienced in the S&P 500 are between 2% and 6%. In this study, I will be narrowing the focus specifically on closing price declines of 5%. As legendary trader and trend follower, Ed Seykota was known for saying, “The trend is your friend except at the end when it bends.” The bend in the trend and how quickly it occurs is the focus of Section One. The initial 5% downward move will be classified as the initial “bend in the trend” to be studied in determining if the trend truly has ended.

While all investors have unique and varying degrees of risk tolerance and time horizons, the data used throughout this paper will be the closing daily values of a

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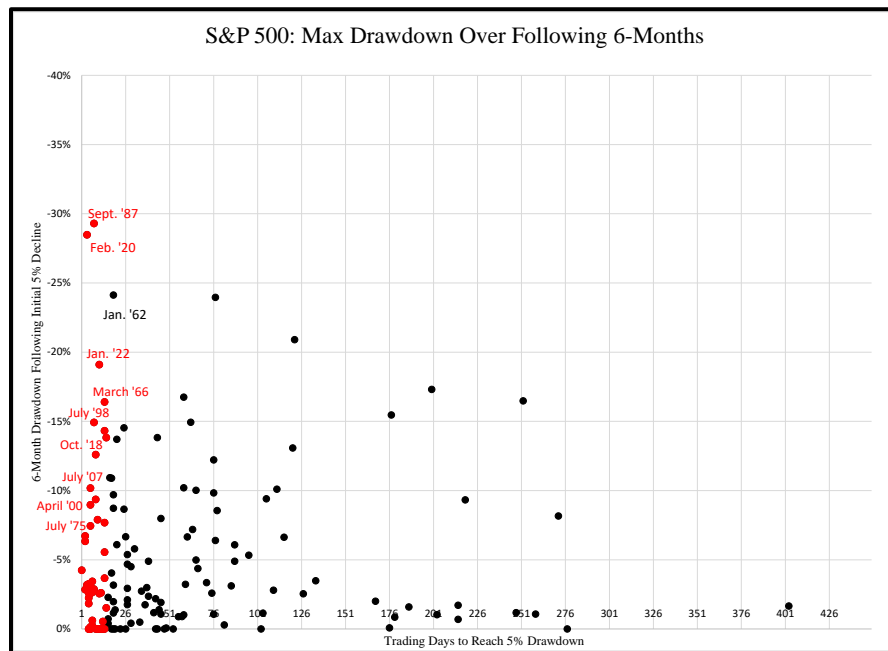
<sup>14</sup> See Brock, Lakonishok & LeBaron, 1992

stated index obtained from Optuma Software. The two primary indices used in the study will be the S&P 500 and Dow Jones Industrial Average. The S&P 500 is often believed to be the most widely tracked index and viewed as a broad barometer of the U.S. financial market. The Dow Jones Industrial Average, while a smaller sampling of individual securities, has a long history that covers multiple market cycles.

Applying the broad concept of the brachistochrone curve and the insights uncovered by Newton and Bernoulli, which showed that the fastest path between two points involved early speed in an objects decline, Figure 3 and Figure 4 show scatter plots for the S&P 500 and Dow Jones Industrial Average, respectively. Plotted in both figures are the number of trading days it took each index to decline by 5% and the resulting drawdown the index experienced over the following six months after the initial 5% move. The declines that were 15 days or less are plotted in red. Note that the majority of the largest declines often occurred when the index saw the initial decline develop in just three weeks. Included are significant market events such as the Great Depression era of the 1920s and 1930s, the Black Monday market crash of September 1987, the inflation-induced crash of 1946, the bear markets that began in 2000 and 2007, as well as the more recent Covid Crash in 2020 and bear market of 2022. From this look at market history, it appears equity market indices do subscribe to Bernoulli and Newton's concept of the significance

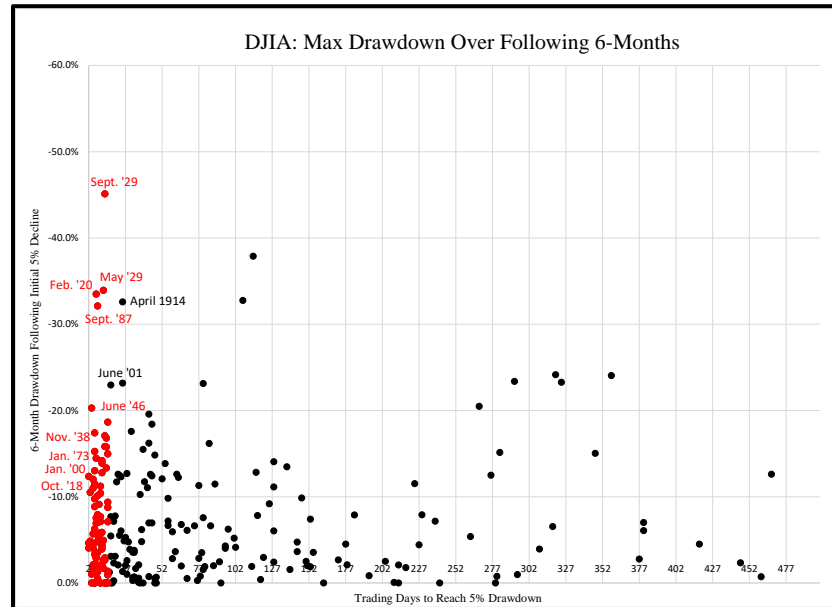
early speed has on the ultimate path taken by an object – and in this case – equity prices.

**Figure 3:** The Relationship Between Time to a 5% Drawdown in the S&P 500 and Resulting Decline



*S&P 500 closing values from January 1950 through September 2022 that resulted in a 5% decline from a 52-week high. Vertical axis shows resulting drawdown six months following a 5% decline from a 52-week high.*

**Figure 4:** The Relationship Between Time to a 5% Drawdown in the DJIA and Resulting Decline



*Dow Jones Industrial Average closing values from January 1900 through March 2022 that resulted in a 5% decline from a 52-week high. Vertical axis shows resulting drawdown six months following a 5% decline from a 52-week high.*

In the early 20<sup>th</sup> century, canaries and other birds were used in coal mines as early detectors of carbon monoxide. John Haldane, an expert in respiratory physiology, is credited with the initial suggestion of using birds to provide an early warning of the poisonous gas. This was due to their higher metabolic rates compared to humans, which meant they showed symptoms faster, such as before gas levels reached dangerous levels to the coalminers.<sup>15</sup> Just like the canary, the observation of a 5% decline in major equity indices, within a 15-day period, also acts as an “early warning” of what could potentially turn into a material decline in the equity market. With that, we can title these developments “5% Canary” signals.

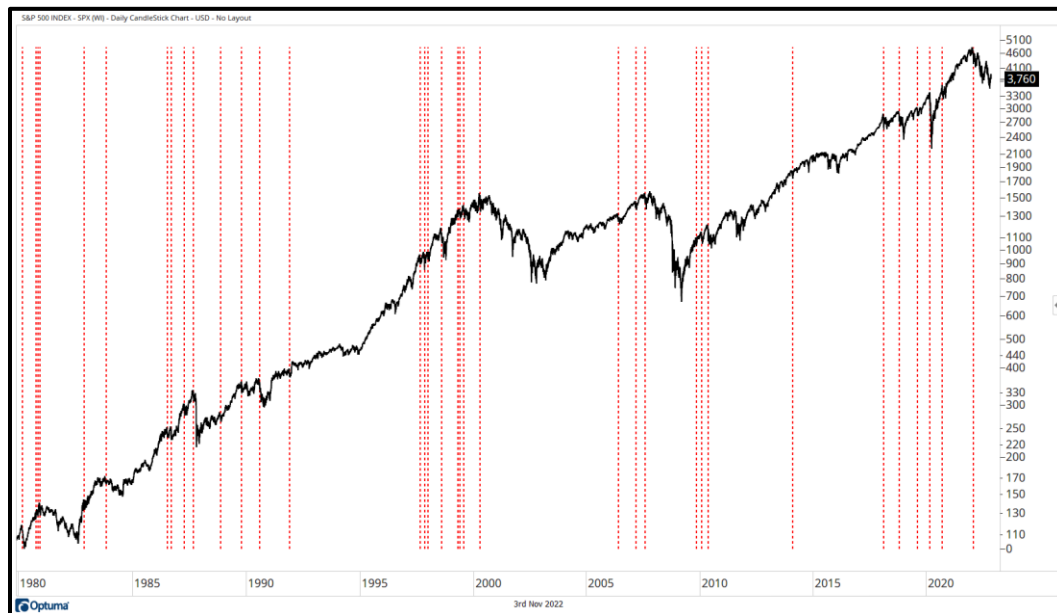
<sup>15</sup> See Sekhar & Haldane, 2014

If seeking an explanation outside of 17<sup>th</sup> century mathematics for the evident correlation between quick initial declines and material drawdowns, a cornerstone of technical analysis, the concept of momentum is well-suited for the task. Using a classic definition of momentum, a measurement of change over a specified period in order to gauge the strength or weakness of an underlying trend, shows that this accumulation of strong price action in the indices to the downside builds upon itself and draws in additional sellers, historically resulting in larger-than-average drawdowns. However, as this paper will show, momentum alone does not account for the separation of outcomes based on the time for the 5% decline to take place. Momentum is the kindling that is lit with the proverbial match of “early speed” in the 5% Canary signals that result in above-average weakness in the equity indices. Building on the work cited previously by Barber and Odean, on attention-grabbing data having an impact on the emotionally driven investor behavior, the initial 5% declines in the indices that occur at an accelerated rate likely garner a higher degree of attention and with it, trade activity. The findings of Kaminski and Lo also applies here, that the resulting declines in the equity indices are larger than average, “...in the event of a significant drop in aggregate stock prices, investors who are generally passive will become motivated to trade.”<sup>8</sup>

Shown in Figures 3 and 4, a relationship for both the S&P 500 and the Dow Jones Industrial Average has been identified between 5% Canary declines and some of

the largest drawdowns that have taken place since 1950 and 1900, respectively. However, not all 5% Canary signals result in a steep and material sell-off. As shown in Figure 5, 5% Canary signals have been produced throughout history, several have shown to be “ignored” by the market and no major decline has come to pass.

**Figure 5:** 5% Declines From a 52-Week High in The S&P 500



*S&P 500 daily line chart from 1980 through November 2<sup>nd</sup>, 2022. Red lines indicate the first 5% decline from a 52-week high that has taken place within 15 trading days. Repeated instances within 21-days have not been shown.*

The next step to be taken in the process of formalizing a methodology for using 5% Canary signals as an early warning protocol for equities is to seek a form of price confirmation. With confirmation, we can begin filtering the 5% Canaries that carry a higher degree of downside risk from those that the market ultimately disregards. Moving Averages are common tools used within technical analysis, with 50-day

and 200-day Simple Moving Averages (SMA) being popular lookback periods used when technicians are applying trending identification analysis. Moving averages are arithmetic averages of the price of a security or index over a specified period of time. Paul Tudor Jones also believed the 200-day SMA was a useful tool, “My metric for everything I look at is the 200-day moving average of closing prices. I’ve seen too many things go to zero, stocks and commodities.”<sup>16</sup> Siegel (2014) showed that the 200-day SMA offers a degree of superiority to a passive buy-and-hold investment approach during the 1886 to 2006 period for the Dow Jones Industrial Average. The caveat that Siegal points out is a SMA-based market timing strategy can succumb to whipsawing markets, periods of non-trending price activity.<sup>17</sup> Siegal is correct, when used in isolation, the obstacle to using smoothing mechanisms like moving averages when price volatility is elevated, and a trend is unable to be established. In this paper, the usage of a moving average is applied as a form of signal confirmation rather than initial or standalone signal generation. Applying the 200-day SMA to the index charts we can begin seeking affirmation of the 5% Canary signal occurrences. The confirmation methodology is as follows:

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<sup>16</sup> See Robbins, 2016

<sup>17</sup> See Siegel, 2014

When the underlying index declines by 5% within 15 days from a 52-week high, (producing the 5% Canary signal), and closes under the 200-day SMA for two consecutive days.

Going forward, these instances will be called “Confirmed 5% Canary” signals.

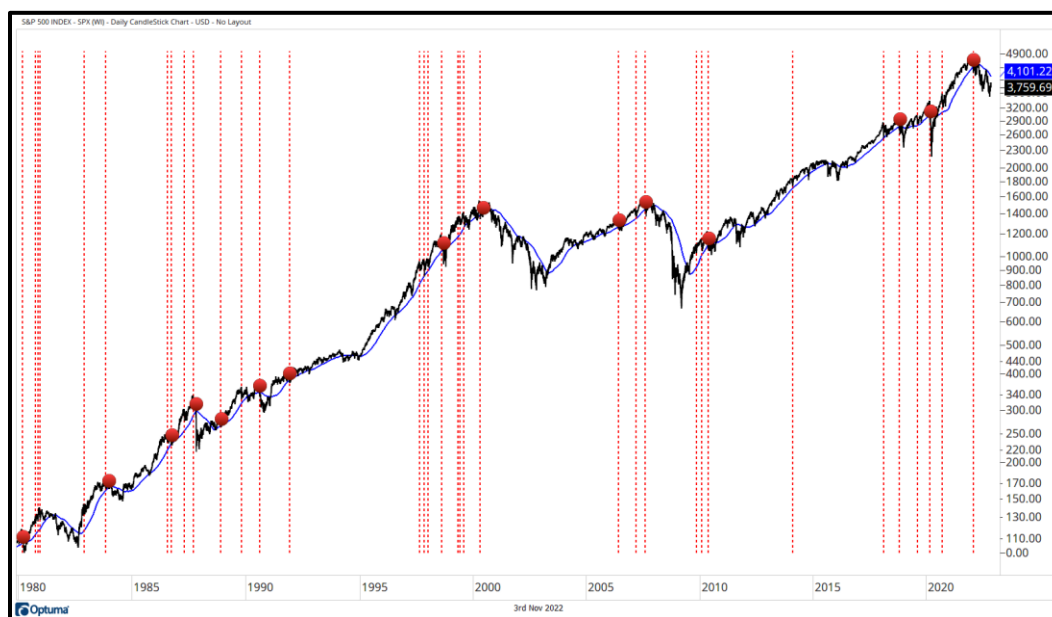
Like many forms of analysis, whether in academia or financial markets, validation of a hypothesis or a price-based signal or indicator provides clarity and verification. For the purposes of this paper, the consecutive closes below the 200-day SMA are sought to occur within two months (42 trading days) of an identification of a 5% Canary signal. This period was selected, and not optimized to avoid curve fitting, to allow ample opportunity for price action of the index to confirm the perceived trend change as noted by the initial signal.

In Figure 6, the same chart of the S&P 500 as used in Figure 5 is shown but with the addition of red dots at the price points when the index has closed below the 200-day SMA for two consecutive days, providing the Confirmed 5% Canary signal. Since 1980, there have been just 15 Confirmed 5% Canary signals in the S&P 500 and 14 Confirmed 5% Canary signals in the Dow Jones Industrial Average (Figure 11 in the Appendix). Included in this sampling are the significant market events that were noted by the 5% Canary signals in Figures 3 and 4. This includes the Great Depression, 1987 Crash, bear market following the Tech Bubble of 2000, Financial Crisis of 2008, Covid Crash of 2020, and the bear market that



began in 2022. Of the 15 Confirmed 5% Canary signals on the S&P 500 sampling shown on Figure 6, only four did not occur ahead of what resulted in a double-digit drawdown for the index. Since 1980, only one drawdown of -20% or more for the S&P 500 did not receive a Confirmed 5% Canary signal (the bear market of 1981-1982).

**Figure 6:** Confirmed 5% Canary Signals

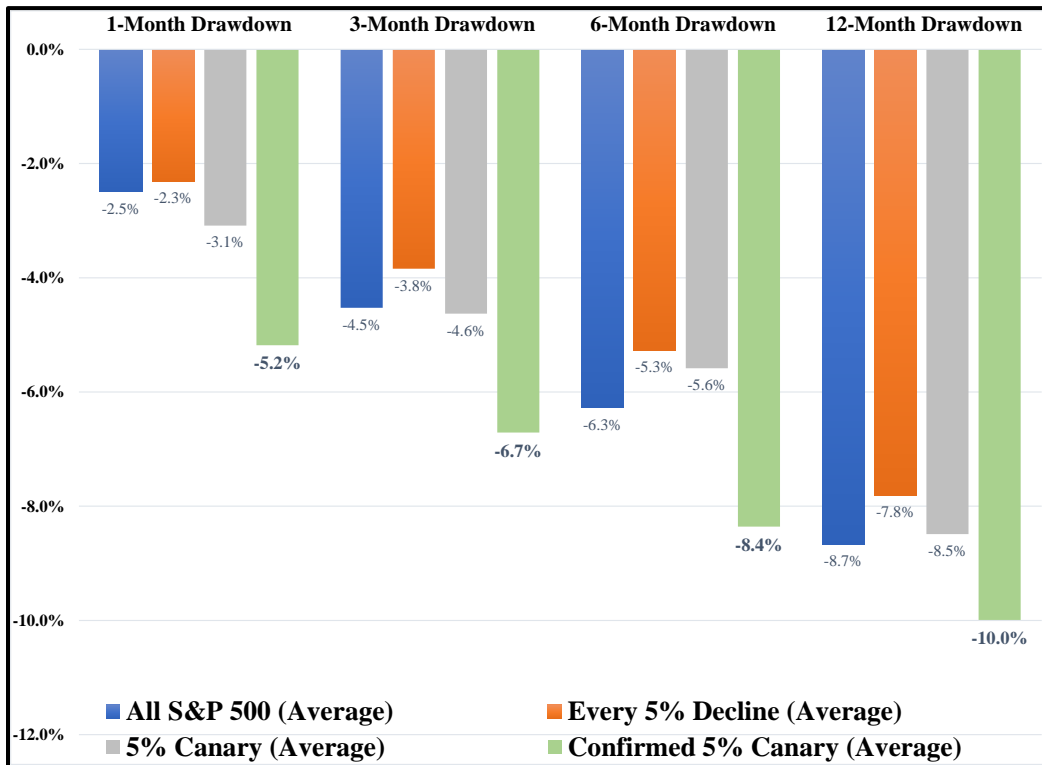


*S&P 500 daily line chart from 1980 through November 2<sup>nd</sup>, 2022 with a 200-day SMA. Red lines indicate the first 5% decline from a 52-week high that has taken place within 15 trading days. Red dots indicate price confirmation of 5% Canary signals based on the index experiencing two consecutive closes below the 200-day SMA within 42 days of the a 5% Canary signal.*

Comparing the resulting price declines for the S&P 500 in Table 1 and the Dow Jones Industrial (Table 3 in the Appendix), both average and median drawdowns for 1-month, 3-month, 6-month and 12-month periods are shown. We can see in Figure 7 that more severe price weakness is witnessed following 5% Canary and Confirmed 5% Canary periods compared to the entire sampling of all 5% declines

that take place regardless of length of time. For the S&P 500, the median decline 3- and 6-months after Confirmed 5% Canary signals is over twice the size of the Every 5% Decline group.

**Figure 7:** Comparison of Average Drawdowns Across Various Timeframes



Bar chart of the average drawdowns across multiple timeframes based on S&P 500 data from January 1950 through October 2022.

**Table 1:** Average & Median Drawdowns For the S&P 500

	1-Month Drawdown	3-Month Drawdown	6-Month Drawdown	12-Month Drawdown
All S&P 500 (Average)	-2.5%	-4.5%	-6.3%	-8.7%
Every 5% Decline (Average)	-2.3%	-3.8%	-5.3%	-7.8%
5% Canary (Average)	-3.1%	-4.6%	-5.6%	-8.5%
Confirmed 5% Canary (Average)	-5.2%	-6.7%	-8.4%	-10.0%
All S&P 500 (Median)	-1.6%	-3.0%	-4.0%	-5.3%
Every 5% Decline (Median)	-1.4%	-2.1%	-3.0%	-4.8%
5% Canary (Median)	-2.0%	-2.6%	-2.8%	-6.7%
Confirmed 5% Canary (Median)	-2.6%	-5.0%	-6.9%	-7.8%

S&P 500 data from January 1950 through October 2022. 5% declines are measured from 252-day closing high on the index.

This decisively shows that the resulting drawdowns in equity indices following an initial 5% decline are not solely the result of price momentum. Instead, it shows the significance of the time duration the decline occurs in having a larger impact on the ultimate price deterioration that has historically followed.

The data for both the S&P 500 and Dow Jones Industrial Average show outsized drawdowns for 1-, 3-, 6-, and 12-month periods when compared to the Every 5% Decline group. Viewed in the context of economic recessions, since 1925 there have been just three of the 16 NBER classified recessions that were not first preceded by a Confirmed 5% Canary signal on either the S&P 500 or Dow Jones Industrial Average (Figure 12 of the Appendix). A closer look at the price history over the last six years is also shown with 5% Canary and Confirmed 5% Canary signals in Figure 13 of the Appendix.

## **Section Two: Buy The Dip**

Throughout the bull market of the 1990s, traders were rewarded for buying nearly each dip in the market as stocks charged higher month after month. This “buy the dip” mentality bred overconfidence and helped add air to the expanding bubble that eventually popped, resulting in the bear market that lasted nearly three years. As human behavior often repeats itself, the “buy the dip” approach grew once again in popularity during the decade following the Financial Crisis and intensified the year after the Covid Crash in 2020. All good things come to an end and the

equity market showed the faults of this superficial strategy with outsized declines that wreaked havoc on many investors' portfolios.

As Section One showed, 5% Canary signals provide early warning to potential major declines in the equity market that then increase in confidence through Confirmed 5% Canary signals. The next question we must ask pertains to the potential significance of 5% declines that take longer than 15 days to develop. One method for validating robustness of a signal is through the review of conditions that do not meet the stated criteria. Section Two of this paper will look to improve upon the "buy the dip" strategy through a more quantitative approach with a focus on when an equity index takes longer than 15 days to experience a 5% decline.

Identifying and respecting the long-term trend of the market is an important first step in determining if a dip presents the proper criteria to warrant an opportunity for mean-reversion in price. Moving averages are popular tools used in trend identification. Similar to the confirmation criteria used in the Confirmed 5% Canary signal of Section One, intermediate and long-term moving averages can be used to identify up and down trends of a respective index. Faber showed that monthly moving averages provide superior returns in active management of portfolios.<sup>18</sup> In a paper published in *The Journal of Wealth Management*, Kilgallen showed that Simple Moving Averages produced 28% less drawdown than a buy-

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<sup>18</sup> See Faber, 2007

and-hold strategy for commodities, 44% less for equities, and 65% less downside for currencies.<sup>19</sup> Kirkpatrick and Dahlquist also showed that moving averages are useful in identifying trends, “you can see how the moving average tends to follow the trend line fairly well. The moving average then becomes a proxy for the trend line and can be used to determine when a trend is potentially changing direction, just as a trend line can.”<sup>20</sup>

For the purposes of this paper, the 50-day Simple Moving Average (SMA) above the 200-day Simple Moving Average (SMA) will be used for classifying up trends within the index. Only qualifying signals found on a closing basis on daily charts of the index when the 50-day SMA closes above the 200-day SMA will be recognized. Figures 8 and 9 show daily charts of the S&P 500 and Dow Jones Industrial Average with green arrows used to show when the respective index has declined by 5% from a 52-week high that exceeded 15 trading days while the underlying index was in a defined-up trend based on the above-mentioned moving averages. Going forward, these occurrences will be called “Buy The Dip” signals.

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<sup>19</sup> See Kilgallen, 2012

<sup>20</sup> See Kirkpatrick & Dahlquist, 2008

**Figure 8:** Confirmed 5% Canary & Buy The Dip Signals For the S&P 500



*S&P 500 daily line chart from 1980 through November 2022 with Confirmed 5% Canary signals shown in red dots and Buy The Dip signals shown in green arrows.*

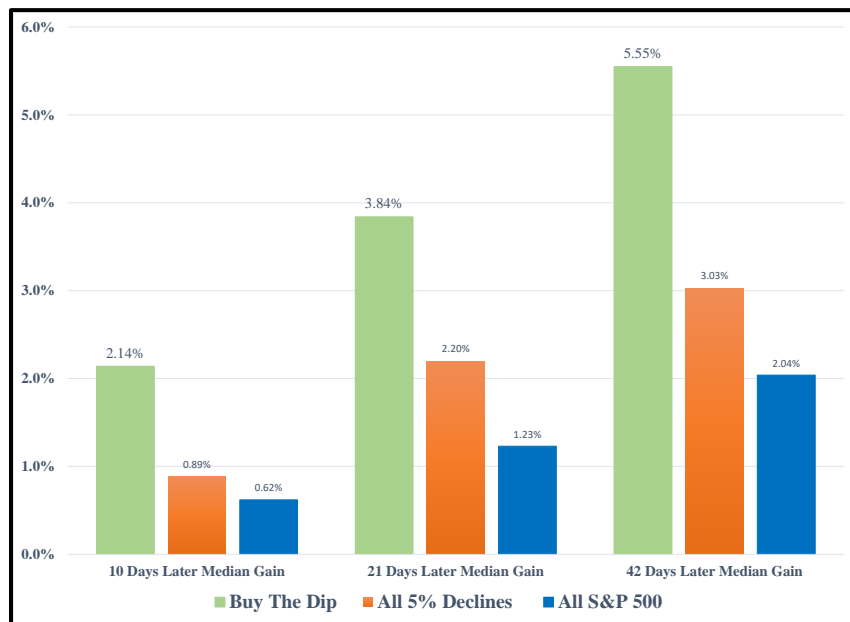
**Figure 9:** Confirmed 5% Canary & Buy The Dip Signals For the DJIA



*Dow Jones Industrial Average daily line chart from 1980 through November 2022 with Confirmed 5% Canary signals shown in red dots and Buy The Dip signals shown in green arrows.*

Since 1980, the S&P 500 was higher 66.7% of the time two weeks after Buy The Dip signals with a median gain of 2.14%, compared to all declines of 5% within an uptrend, which resulted in a median gain of less than 1%. As shown in Table 2, two months after Buy The Dip signals saw the market higher 87.5% of the time with a gain of over 5.5%, compared to less than 70% for the full sample of 5% declines that saw a median gain of 3% during the same period. Alongside the improved upside probability of the Buy the Dip signals, the range of historical outcomes produced a larger spread between the 80<sup>th</sup> and 20<sup>th</sup> percentiles compared to the All 5% Decline group, offering a more attractive risk/reward profile based on historical outcomes.

**Figure 10:** Change in the S&P 500 Following Buy the Dip Signals & All 5% Declines



*Values based on closing values of the S&P 500 from January 1980 through June 2022. Buy The Dip signals based on 5% declines from 52-week highs that take more than 15 days to occur. Both Buy The Dip signals and All 5% Decline instances were included when occurring in up trends based on the 50-day SMA closing above the 200-day SMA.*

**Table 2: Data Results from Buy The Dip and All 5% Declines Over Various Timeframes**

	<b>Buy The Dip</b>	<b>All 5% Declines</b>	<b>All S&amp;P 500</b>
<b>10 Days Later % Higher</b>	66.67%	63.01%	60.38%
<b>10 Days Later Median Gain</b>	2.14%	0.89%	0.62%
<b>80th/20th Percentile</b>	3.48%/-1.62%	3.58%/-1.95%	2.47%/-1.63%
<b>21 Days Later % Higher</b>	75.00%	65.90%	63.96%
<b>21 Days Later Median Gain</b>	3.84%	2.20%	1.23%
<b>80th/20th Percentile</b>	5.1%/-0.35%	5.1%/-1.97%	3.8%/-2.14%
<b>42 Days Later % Higher</b>	87.50%	69.36%	67.10%
<b>42 Days Later Median Gain</b>	5.55%	3.03%	2.04%
<b>80th/20th Percentile</b>	8.19%/0.89%	7.03%/-1.77%	5.89%/-2.2%

*Values based on closing values of the S&P 500 from January 1980 through June 2022. Buy The Dip based on 5% declines from 52-week highs that take more than 15 days to occur. Both Buy The Dip signals and All 5% Decline instances were included when occurring in up trends based on the 50-day SMA closing above the 200-day SMA.*

The superior risk/reward profile presented through this nearly 42-year study on the S&P 500 shows the validity of the Confirmed 5% Canary signal as well as the opportunities offered when market declines are not classified as a 5% Canary. As Albert Einstein once said, “Everything should be made as simple as possible, but not simpler.” Section Two was not structured on the basis of optimized data, timeframes, or signal thresholds; criteria and structure of the studies presented were intentionally kept simple and broad. While the focus of this paper was on the S&P 500 and Dow Jones Industrial Average, foreign markets were also tested, which showed similar results as the U.S. equity indices. One distinction found with non-U.S. indices was that the volatile nature of several less developed and emerging markets produced less meaningful signals than the larger developed markets.



The value of the study stands firmly in the resulting data of the improved risk management of quick initial market declines and in the opportunities presented to investors by index declines that take a protracted period of time.

## Conclusion

This paper provides a data-driven argument for using the amount of time it takes an equity index to decline by 5% to serve as either an early warning sign of a material decline in the market or an opportunity to Buy The Dip with the assumption the market will reverse its decline and move higher. Through a study of market history from 1900 on the Dow Jones Industrial Average and 1950 for the S&P 500, Figures 3 and 4 showed the relationship between the resulting drawdown and the initial decline of the two equity indices. A relationship was found in the observation that many of the largest drawdowns in market history began by initially declining by 5% within 15 days. The 5% Canary signal was improved upon with the inclusion of the 200-day Simple Moving Average to assist with price confirmation of the initial signal. With a median drawdown for Confirmed 5% Canary signals of -5% after 3-months compared to -2.1% for all 5% declines for the S&P 500 and -5.3% and -3.3% for the DJIA, respectively, the concept of the 5% Canary proves to be meaningful throughout market history.

The concept of measuring the time to a 5% decline was also shown to have value in a bullish context as well, with the S&P 500 rising over 87% of the time in the

two months following a Buy The Dip signal, resulting in a 45% higher median gain compared to all 5% declines in the S&P 500 and a 63% higher median gain than all two month periods for the index. The insight provided by Kaminski and Lo (2014), that investors pay greater attention to significant declines in the market than they typically would, explains the need for a proper lens to view declines such as these and to be better prepared with what action if any should be taken.

Built upon the foundation of technical analysis research, this study of 5% declines from both the viewpoints of bullish and bearish market outcomes offers a unique methodology to the investment community that can be applied by both retail and professional investors. The creation of a complete trading strategy or system is not the objective of this paper. Analysis on other trend classification and/or additional criteria could be studied and tailored to the Confirmed 5% Canary and Buy The Dip signals presented in Sections One and Two to better fit an investor's risk tolerance and trade preferences. Finally, the idea of the "early speed" in an object's path that was initially introduced by the creation of the brachistochrone curve in the 1700s has been shown in this paper to have robust application to financial markets when applied to index price changes and offers investors another tool to be deployed in both downside risk management and upside opportunistic applications.

## Resources

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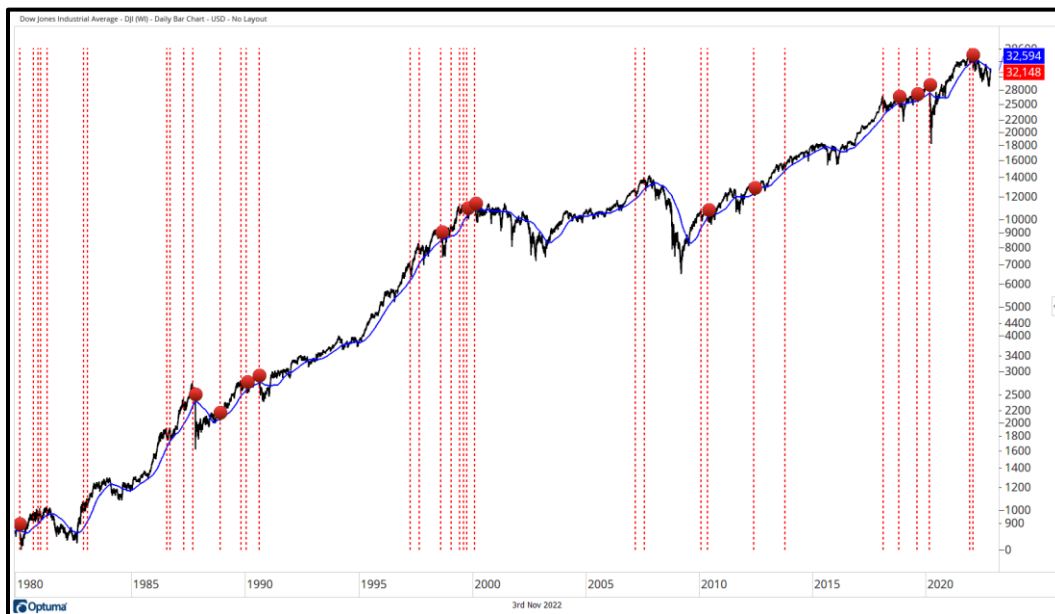
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## Appendix

**Figure 11: 5% Canary & Confirmed 5% Canary Signals For The DJIA**



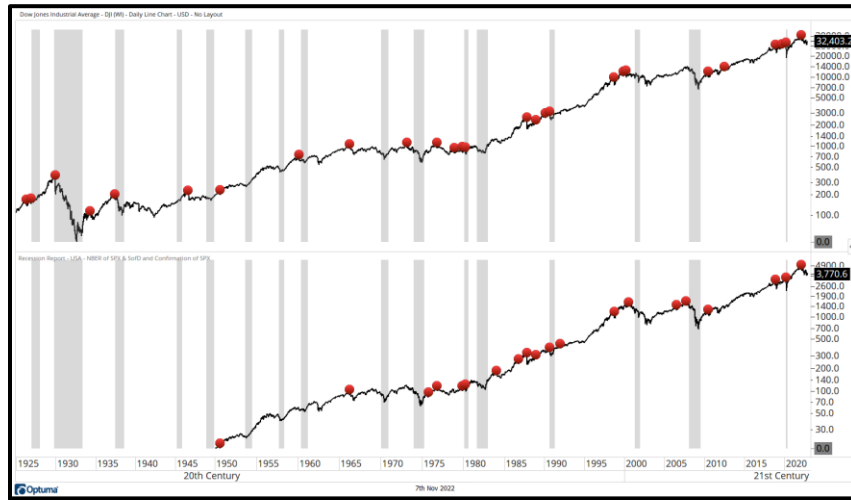
*Dow Jones Industrial Average daily line chart from 1980 through November 2nd, 2022, with the 200-day Simple Moving Average. Red vertical lines indicate the first 5% decline from a 52-week high that has taken place within 15 trading days. Red dots indicate price confirmation of 5% Canary signals based on the index experiencing two consecutive closes below the 200-day SMA within 42 days of the initial 5% Canary.*

**Table 3: Average & Median Drawdowns For the DJIA**

	1-Month Drawdown	3-Month Drawdown	6-Month Drawdown	12-Month Drawdown
All DJIA (Average)	-2.9%	-5.4%	-7.7%	-10.8%
Every 5% Decline (Average)	-3.0%	-5.3%	-7.6%	-10.9%
5% Canary (Average)	-3.0%	-5.4%	-7.8%	-11.0%
Confirmed 5% Canary (Average)	-7.7%	-10.0%	-11.5%	-16.0%
All DJIA (Median)	-1.8%	-3.4%	-4.8%	-6.8%
Every 5% Decline (Median)	-1.9%	-3.3%	-5.1%	-8.1%
5% Canary (Median)	-1.8%	-3.9%	-5.1%	-7.9%
Confirmed 5% Canary (Median)	-2.9%	-5.3%	-7.6%	-10.8%

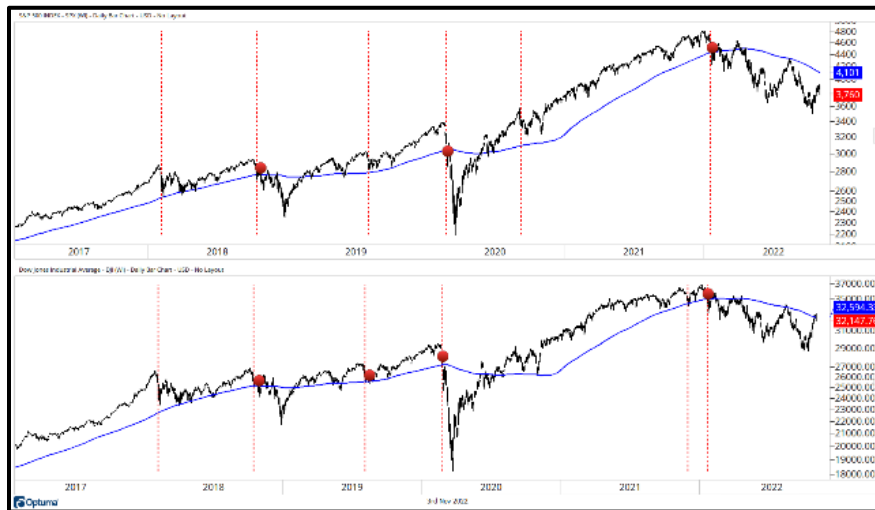
*Dow Jones Industrial Average data from January 1900 through October 2022.*

**Figure 12: Recession Periods Since 1925**



*Dow Jones Industrial Average since 1925 and S&P 500 since 1950 with NBER classified recession periods shown in gray and Confirmed 5% Canary signals shown with red dots.*

**Figure 13: 5% Canary & Confirmed 5% Canary Signals For The DJIA and S&P 500**



*S&P 500 and Dow Jones Industrial Average daily bar chart from 2017 through October 2022. Price with 200-day Simple Moving Average (blue line), 5% Canary (vertical red lines) and Confirmed 5% Canary Signals (red dots) shown.*