

SEARCH FOR PROBABILITIES

by **Garrett Baldwin**

Annotations
by Rohr

As a veteran 'macro-technical' analyst, statistics/probability are not my cup of analytic tea. Yet these are some very strong insights on types of analysis that drive quite a lot of investments. Kudos to Baldwin on well-researched and clear ideas in this important area. The failure of most of these 'sell side' projections in a 'changing' situation is not surprising to experienced hands.

Thinking in terms of probability is a central tenet of being a Superforecaster. Yet, when it comes to projections, all too often forecasts are delivered in 30-second sound bites or a tweet. We reached out to EidoSearch, a forecasting firm that uses a patented pattern matching technology, to project event outcomes and find relationships in Big Data.

When examining data, EidoSearch President and Co-founder David Kedmey says investors should take a disciplined approach to discover a better understanding of future events.

"There are three questions: First, what does it mean to make an investment decision? Next, what's the most likely outcome for an investment and what are the range of outcomes?" Kedmey says. "Finally, what is the probability of successful investment? That third question is the hardest to answer."

EidoSearch aims to answer those questions and provides a deeper assessment of the ranges and probabilities of forecasts issued by Wall Street's most prominent analysts in both 2015 and in 2016 (see "Range of outcomes," page 23). Using a conditional probability assessment, investors can better understand the likelihood of a projection issued by a 30-year Wall Street veteran or your uncle who thinks that Apple stock is heading to \$200 by the end of next year.

"The big idea is how to use a world of data," says EidoSearch CEO and Co-Founder, Dr. Steven Zhang. "Our methodology is data-incident based modeling (DIB). Think about how people look at things. For example, look at Apple stock. If you ask a series of questions—why people think a certain way—they will base it on past experience. They know if they have seen something before. From experience, they look at criteria and say that Apple should go here."

The process relies on collecting as much data as possible. First, EidoSearch identifies a data series in any

historical data set and searches for multiple patterns. Next its search technology identifies similar conditions across the data stream and returns the most relevant results. Then, the technology analyzes the results and generates a probabilistic range of outcomes that could not be produced by other modeling techniques.

"People try to make predictions in terms of probabilities," says Zhang. "Everything has a probability, including the weather forecast. From experience, a person has seen a scenario before. Now, technology allows us to use a computer to compute these conditions. We can look through history [and find] all of its conditions, all of its patterns; and situations are matched."

Naturally, that concept of history is to understand rare events that could lead to a significant downturn or surges in the price of a particular equity or commodity.

"There are two important aspects to what we do when looking at events," says Zhang. "We can factor in the probability of a rare event. This hasn't happened many times, but it has happened before. You have to have seen this type of scenario before to make that type of prediction. We then quantify that prediction in order to

give a statistical representation of those events. Next, using our methodology, we look at the stability of the historical distribution. We can say, 'here is the prediction,' but know there is still uncertainty based on the distribution."

Although technology and academic research are advancing the importance of thinking about probabilities, Zhang acknowledges that barriers still exist.

"Human nature is to want something certain. We want better organization, but it's kind of lazy to simply want to know the outcome. But probability is based on knowledge. You can say that there is an 80% chance of rain, but people just want you to tell them whether they should bring an umbrella [or not]." ▲

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— **Dr. Steven Zhang**

Making prediction is about a range of probabilities.

“Range of outcomes,” below, provides an assessment of equity and commodity markets based on a conditional probability assessment for 2015 and 2016. All 2015 projections are based on data available on Jan. 1, 2015 and provide an assessment of the probabilities of certain price targets on Dec. 31, 2015.

For data projections in 2016, all data was analyzed during the first week of December and offers the probabilities of certain price points during the first week of December 2016. The following is a range of probabilities on where the U.S. unemployment rate will sit during the first week of 2016. When looking at the top figure—the percentages listed—each signifies the probability that the associated figure will be at this level of unemployment or less.

This means that there is a 40% chance that the unemployment rate will be at 4.52% or less during the first week of December 2016. It also means there is a 60% chance that unemployment will be at 4.52% or higher for the same period.

EidoSearch also breaks down each figure in terms of 10% probability buckets. Based on the figures below, there is a 10% chance that unemployment will fall between 4.6% and 4.7% in December 2016, just as there is a 10% chance that it will fall between 5.04% and 5.74% and a 10% chance that it will be above 5.74%.

Per.	U.S. 2016
10%	3.98%
20%	4.16%
30%	4.40%
40%	4.52%
50%	4.60%
60%	4.70%
70%	4.96%
80%	5.04%
90%	5.74%

RANGE OF OUTCOMES

10-Year Yield

Per.	10-year yield 2015
10%	1.63%
20%	1.87%
30%	2.01%
40%	2.16%
50%	2.32%
60%	2.37%
70%	2.48%
80%	2.83%
90%	3.25%

The Federal Reserve’s decision to not raise interest rates after the end of its third round of quantitative easing was one of the most important stories of the year for the markets. In the second week of December 2015, the 10-year sat at 2.12%, well below the expectations of every major analyst projecting in *Barron’s* or in other major media outlets. Interestingly, EidoSearch’s conditional probability expected that there was a 50% chance that interest rates would be at or below 2.32%.

Meanwhile, every projection made in *Barron’s* in 2015 was in a less probable range for the year. Subramanian and Lakos-Bujas were the only two analysts whose projections fell in the 70% to 80% band, meaning that the probability of their rate estimate was a little less than 25%. Meanwhile, Praveen at Prudential fell in the 90% range of estimates. There was only a 10% probability that rates would be 3.25% or higher at year end, meaning his estimate of 3.5% faced even greater odds.

Bank of America	Savita Subramanian	2.75%
JP Morgan Chase	Dubravko Lakos-Bujas	2.80%
Barclays	Jonathan Gilonna	2.85%
Morgan Stanley	Adam Parker	2.85%
Columbia Management	Jeffrey Knight	2.90%
Citi Research	Tobias Levkovich	2.95%
Goldman Sachs	David Kostin	3.00%
BlackRock	Russ Koesterich	3.00%
Federated Investors	Stephen Auth	3.00%
Prudential International	John Praveen	3.50%

Much as in S&P 500 projections below, the glaringly apparent 'herd instinct' is very striking. All grouping in the upper 2.00% area seemed a recipe for failure. Yet the 'received wisdom' did not see the weak factors like lack of structural reform coming after US growth firming in 2014.

Considering the degree to which everyone allegedly 'learned their lesson' in 2008, it is very interesting to see 'herd instinct' at work in major sell side research department projections. The same goes for the ingrained optimism. That left all the firms on the high side for 2015. It appears the same for 2016 forecasts in spite of well-anticipated weaker fundamentals.

Per.	S&P 2015 End
10%	1,828
20%	1,999
30%	2,093
40%	2,177
50%	2,218
60%	2,277
70%	2,369
80%	2,481
90%	2,646

Each December, media outlets corral the top analysts on Wall Street and ask for their projections on how the S&P 500 will perform by the end of the following year. *Barron's* releases its annual roundtable, while other sites like *Business Insider* accumulate projections for its readers. The S&P 500 was just below the 2,100 target set by three prominent analysts with three weeks to spare in December. But other analysts significantly overshot the year-end figure. As this spectrum by EidoSearch explains, there was a 50% chance that the S&P 500 would sit at 2,218 based on a probability assessment of data compiled on Jan. 1, 2015. This spectrum also points out that there was a 30% chance that the S&P 500 would be at 2,093 or lower at the end of the year (in the range where the figure sat at the time of publication).

Based on its 2015 outlooks released at the end of last year, Stephen Auth of Federated Investors was the most bullish analyst with a target of 2,350. That figure was just below the 70% band listed above. There was roughly a 31% probability that the S&P 500 would hit or surpass Auth's 2015 target.

David Kostin	Goldman Sachs	2,100.00
Jonathan Gilonna	Barclays	2,100.00
Andrew Garthwaite	Credit Suisse	2,100.00
David Bianco	Deutsche Bank	2,150.00
Russ Koesterich	BlackRock	2,160.00
Dan Greenhaus	BTIG	2,200.00
Tobias Levkovich	Citi Research	2,200.00
Savita Subramanian	Bank of America	2,200.00
Jeffrey Knight	Columbia Management	2,200.00
Julian Emmanuel	UBS	2,225.00
Brian Belski	BMO	2,250.00
Dubravko Lakos-Bujas	JP Morgan Chase	2,250.00
John Praveen	Prudential International	2,250.00
Adam Parker	Morgan Stanley	2,275.00
John Stoltzfus	Oppenheimer	2,311.00
Jonathan Golub	RBC	2,325.00
Tom Lee	Fundstrat	2,325.00
Stephen Auth	Federated Investors	2,350.00

S&P 500

Per.	S&P Dec. 1, 2016
10%	1,775
20%	2,063
30%	2,208
40%	2,300
50%	2,365
60%	2,414
70%	2,491
80%	2,583
90%	2,733

Looking toward 2016, EidoSearch projects there is a 50% chance that the S&P 500 will be at 2,365 or higher for the year. Meanwhile, there is a 40% chance that the S&P 500 will be at or below 2,300 during the same time frame. That figure represents the highest projection from the nine analysts whose forecasts we examined this month.

For more wide ranging forecasts from independent analysts, see the following **WHERE WILL MARKETS GO?** article. It seems like the 'indie' analysts are less inhibited about making more significant calls based on their unique perspectives.

David Kostin	Goldman Sachs	2,100
Brian Belski	BMO	2,100
Adam Parker	Morgan Stanley	2,175
Jonathan Gilonna	Barclays	2,200
Andrew Garthwaite	Credit Suisse	2,200
Savita Subramanian	Bank of America	2,200
Julian Emmanuel	UBS	2,275
Jonathan Golub	RBC	2,300
David Bianco	Deutsche Bank	2,250-2,300

Per.	Gold 2015
10%	\$1,037.73
20%	\$1,097.10
30%	\$1,116.34
40%	\$1,130.89
50%	\$1,157.33
60%	\$1,163.03
70%	\$1,181.01
80%	\$1,233.36
90%	\$1,343.36

Peter Schiff at Euro Pacific Capital has said that gold prices are headed to \$5,000 over the long term. But statistically, the odds of it happening in 2016 would signal levels of unimaginable inflation and no resulting societal collapse that would place the importance of bread over the importance of non-edible gold.

Gold

Per.	Gold 2016
10%	\$934.36
20%	\$1,012.08
30%	\$1,020.95
40%	\$1,035.17
50%	\$1,056.21
60%	\$1,062.25
70%	\$1,075.73
80%	\$1,132.78
90%	\$1,228.82

Per.	Apple 2015
10%	\$68.64
20%	\$88.88
30%	\$99.30
40%	\$112.32
50%	\$122.87
60%	\$135.51
70%	\$144.25
80%	\$178.70
90%	\$205.75

Based on historical data, EidoSearch projected that there was a 40% chance that Apple stock would be at or above \$112.32. The stock price of roughly \$115 per share during the first week of December is within the 40% to 50% range projected by EidoSearch's models.

Apple

Based on historical data, EidoSearch projects that there is a 50% chance that Apple stock will hit or surpass \$125.72 in 2016. The bullish call that Apple stock is poised to hit \$200 within 12 months faces steep odds. The probability of Apple stock hitting \$192.12 or greater sits at just 10%, according to a conditional probability assessment.

Per.	Apple 2016
10%	\$85.63
20%	\$102.10
30%	\$111.67
40%	\$119.00
50%	\$125.72
60%	\$138.86
70%	\$157.15
80%	\$175.56
90%	\$192.12

Per.	WTI Crude 2015
10%	\$36.31
20%	\$45.97
30%	\$49.76
40%	\$53.43
50%	\$54.73
60%	\$57.30
70%	\$59.62
80%	\$69.77
90%	\$84.12

The decline of oil prices to near seven-year lows was unlikely, according to EidoSearch. The WTI price of nearly \$37.20 was approaching the range of 10% or less in the final three weeks. EidoSearch's probability assessment had set a 50% likelihood that oil prices would be at \$54.73 or lower for the year. But below \$38 fell near the 12% range.

WTI Crude

While many investment banks, government agencies and research firms assess the price of annual price of oil in terms of averages, EidoSearch's 12-month outlook sets an expectation for a specific day and price in the future. The 14 contributors to this year's *Modern Trader* forecasting issue all set their expectations of where crude prices will fall during the first week of December 2016. As noted, Rod David is very bullish on crude prices, yet a conditional probability assessment shows that his price expectation faces steep odds. In fact, all 14 analysts project that oil will be above \$40.16, which EidoSearch projects will be the center of the distribution. This assessment will be intriguing going forward given that OPEC could dramatically change its production policy and mountains of debt could push many shale companies out of business, suppressing the glut of oil in the United States.

Per.	WTI Crude 2016
10%	\$26.84
20%	\$29.42
30%	\$36.65
40%	\$39.25
50%	\$40.16
60%	\$42.11
70%	\$43.46
80%	\$51.34
90%	\$61.59

It is interesting that MODERN TRADER chose to include the broader range of sources than the major sell side firms research for these projections. Yet the focus on classic "commodities" analysts' views still ended up being on the high side. This is possibly due to the NYMEX WTI future still being up in the \$40 area into the late November deadline for projections.

- Alan Rohrbach: \$45, after trading down into \$32-\$35 range
- Al Brooks: \$50
- Rod David: \$83
- Carl Larry: \$64
- Neil Azous: \$65
- Ellen R. Wald, Ph.D.: \$58, rising after a decline below \$40.
- Matt Weller: \$50
- Mark Wittenstein: \$45
- Christopher Gersch: \$52
- Alan Bush: \$49.50
- Luke Powell: \$50
- Dan Gramza: \$45
- Bluford Putnam: \$45 to \$55
- Jay Feuerstein: \$60 to \$65