In the Southern Indian Sree Krishna Swamy Temple of Ambalapuzha there is a tradition of serving Paal Paysam, or rice pudding, to visiting pilgrims. Legend has it the tradition arose after a chess game between the reigning king, and the Indian deity, Krishna who was disguised as an old travelling sage.

To make the match more interesting, and confident in his playing abilities, the king asked the sage to choose a prize if he won. Claiming to be a man of few material needs, the sage asked for a few grains of rice, with the amount determined using the chessboard. One grain of rice was to be placed in the first square, two grains in the second square, four in the third square, and so on with each successive square doubling the amount of its predecessor. The king considered the requested reward insignificant given the vast riches in his empire and the game began.

Exhibit 1. Rice on Chessboard

Source: https://fantasticnumber.wordpress.com/

Needless to say, the king lost and began placing grains of rice on the board to pay the prize. He quickly realized the true cost of the sage's request. Before long, the royal stockpiles of rice were exhausted and the king determined he would never be able to repay the debt. The sage then appeared in his true form as Krishna and told the king that he did not have to repay the rice immediately but could do so over time. The king began serving rice pudding in the temple freely to the pilgrims every day until the debt was paid off.

There is no need to rush to the temple in Ambalapuzha get your free rice pudding any time soon. They will be fulfilling the king's obligation until the end of time. The geometric progression, or exponential growth, of the amount of rice needed to fulfill the king's obligation appeared insignificant beginning with one grain of rice, but after doubling each successive square 63 more times, the obligation grew to 9,223,372,036,854,775,808 grains of rice on the 64^{th} square alone (2^{63} or more than 9 quintillion).

The total amount of rice on the board would be 18,446,744,073,709,551,615 grains, or over 1.4 trillion metric tons[1]. To put that into perspective, it equates to about 2,800 times 2020's global milled rice production[2].

The story highlights the difficulty humans have in understanding nonlinear relationships.

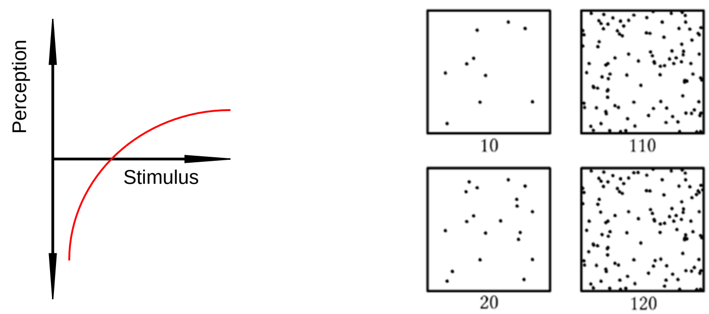
We believe accounting for nonlinear relationships within our predictions gives us a sustainable competitive advantage in accurately forecasting dividend growth.

Wall St. analysts usually take a linear approach in forecasting dividends, utilizing the current payout ratio and multiplying it by their forecasted EPS. In their models, dividend growth is a function of EPS growth, at a one to one ratio (assuming a stable payout ratio which many of them do). As the Harvard Business Review states in an article entitled "Linear Thinking in a Nonlinear World", the human brain likes simple straight lines. However, we know dividends are influenced by much more than just two factors. The general macro environment, management's view on future business prospects, their sustainable free cash flow generation, and where the corporation is in its lifecycle are just a few of the factors affecting prospective dividend growth not accounted for in many models.

The many variables that go into the decision on dividends make forecasting dividend growth accurately quite complex. We have over 1,000 features as inputs into our dividend prediction model. These are specific data points that we believe have some impact on dividends. Of these, 200-300 have a significant effect on our predictions and 20-30 really matter. Even processing the 20-30 highly relevant data points to produce a good prediction without the use of a machine learning model would be extremely difficult, much like trying to get your head around how big 2^{64} really is.

The Weber-Fechner Law states that human perception is a logarithmic function of the amount of stimulus. We are very fast and accurate assessing few data points but slower and less accurate in assessing large amounts of information. In the exhibit below, both bottom squares have ten more dots than the upper ones, but it is much easier to see between the boxes on the left compared to the right.

Exhibit 2. Weber-Fechner Law



Source: Bristol Gate Capital Partners, Wikipedia.

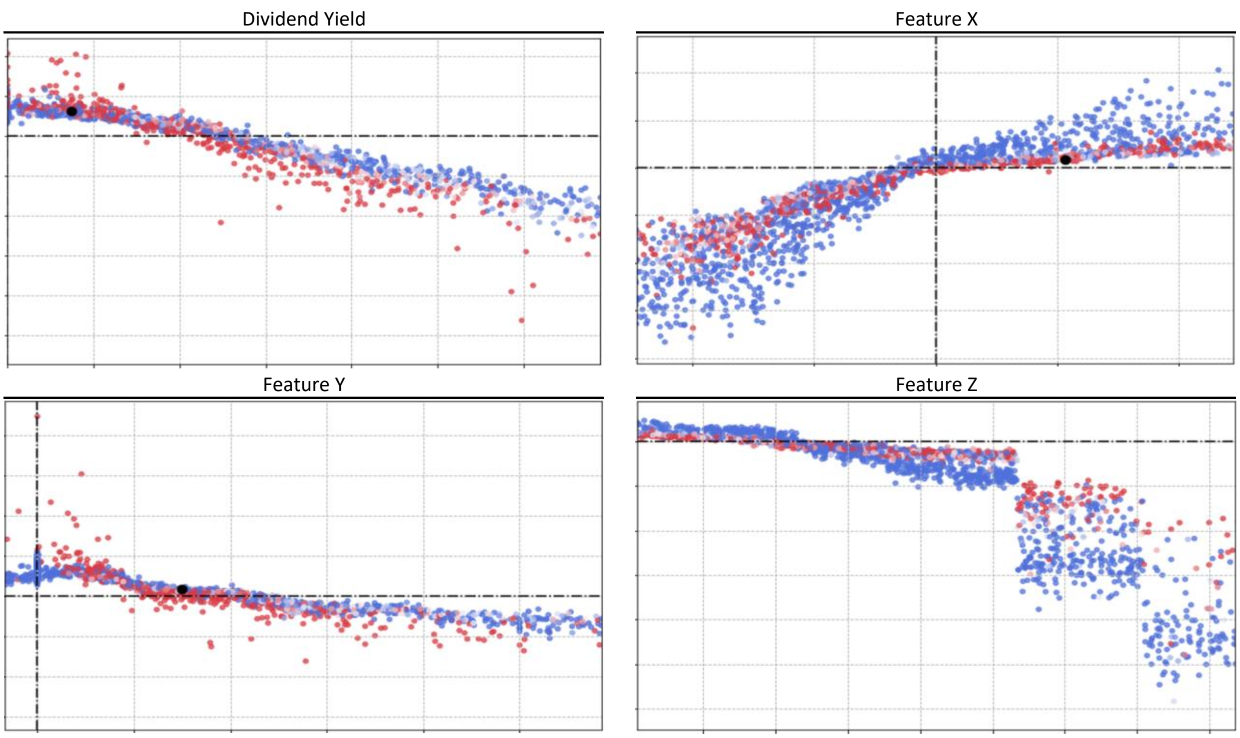
[1] There are various versions of the chessboard and rice story. See Wikipedia, https://en.wikipedia.org/wiki/Ambalappuzha_Sree_Krishna_Swamy_Temple, https://en.wikipedia.org/wiki/Wheat_and_chessboard_problem.
[2] Economic Research Service of the U.S. Department of Agriculture https://www.ers.usda.gov/topics/crops/rice/market-outlook/

In his book, Scale, Geoffrey West defines a complex system as one composed of a myriad of individual constituents that once aggregated take on collective characteristics that are usually not manifesting in, nor could easily be predicted from, the properties of the individual components themselves. The relationships between the variables in our model and their impact on our predictions is greater as a whole and different than the simple linear sum of the component parts.

Our model not only provides us the ability to process many variables but perspective into how each impacts our dividend predictions. **It is not the perceived black box that many often believe it is, but a glass box that allows us to look in and gain unique insights.**

In the graphs that follow, the y-axis represents the contribution to our dividend growth prediction and the x-axis is the value of the feature we are looking at.

Exhibit 3. Feature Impact on Dividend Prediction



Note: Analysis relates to Bristol Gate's US Equity Strategy.

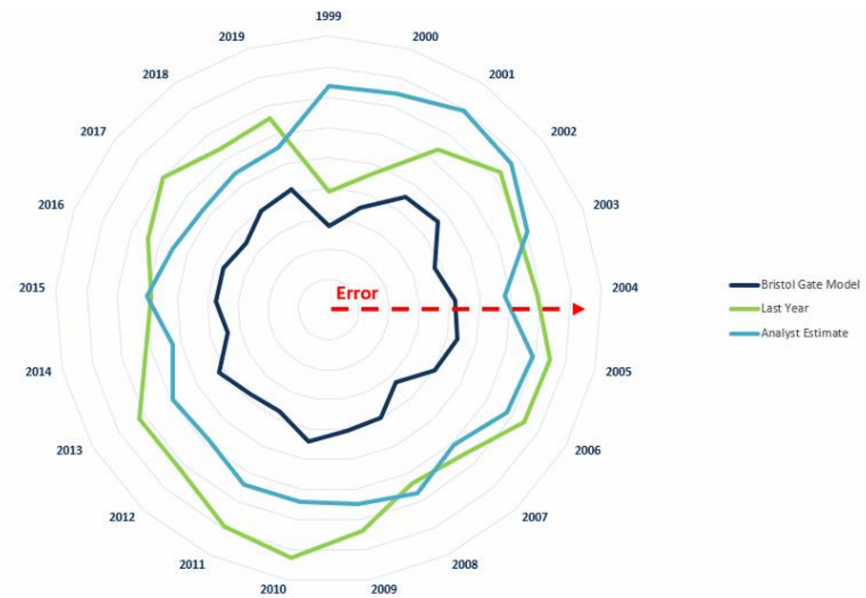
Source: Bristol Gate Capital Partners.

Some features, like dividend yield, represent fairly linear relationships (a straight line). It is not surprising the higher the dividend yield, the more negative the impact on our dividend growth prediction. But other features, we will call them X, Y and Z in this example to protect some of our proprietary insights, do not follow the same pattern and have distinctive influences on our predictions.

For feature X, negative values have a much larger effect (indicated by the slope of the line) than positive values. For feature Y, beyond a certain sweet spot the impact on dividend growth is negative and converges toward a certain number the larger it gets. Feature Z shows minimal consequences on our dividend prediction at low rates, but large, negative step changes as it grows.

Identifying and incorporating nonlinear relationships like these into our predictions is why our model is consistently more accurate at forecasting dividends than the consensus of Wall St. analysts.

Exhibit 4. Average Dividend Growth Prediction Error – Bristol Gate vs Consensus and Naïve Forecasts



Note: Analysis relates to Bristol Gate's US Equity Strategy.

Source: Bristol Gate Capital Partners, FactSet.

While some firms have incorporated advanced analytical techniques as an integral part of their investment processes, we believe we are a long way from the broader market adopting such tools. Until they do, we think we can sustainably identify tomorrow's dividend growers before most others. In the meantime, we continue to develop our analytical capabilities and advance our process forward. Our efforts in data science and machine learning are not restricted to dividend growth or one model, but pervasive throughout our process, including areas such as risk analysis, portfolio construction, and in operating our firm to improve efficiency. Continuous improvement and data science are fundamental components of our culture.

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