



Analyzing prospective financial information

Assessing forecasting accuracy



Analysis of prospective financial information (PFI), also commonly referred to as financial forecasts, is critical when evaluating a company's growth prospects and financial position. Recently, the level of focus on PFI has substantially increased as a result of various factors. For example, PFI used in fair value measurements has been the subject of growing scrutiny from auditors and regulators. In addition, the company-specific risk premium included in discount rates has drawn increased attention, often requiring a detailed analysis of PFI to quantitatively support the assumption. Lastly, a rebound in transaction activity has sharpened the focus on PFI in the finance function of organizations contemplating acquisitions.

This emphasis on PFI begs the question: How does one determine its reliability? This is an important topic that will be explored below. Given the increase in focus on PFI, we have created a series of documents called "Analyzing Prospective Financial Information" to cover relevant topics. This document is the first in the series. We believe this series of documents will be of interest to anyone frequently dealing with PFI in their role. This may include professionals in financial reporting, corporate development, financial planning and analysis, or similar positions.



Calculating forecasting accuracy measures

It is essentially a certainty that actual results will differ from initial projections. When this occurs, how does one determine if the difference is reasonable? One of the best ways to make this assessment is to benchmark the observed level of accuracy to that of other comparable companies. This is accomplished by first calculating forecasting accuracy metrics for the subject company. These metrics are then compared with a peer group to assess the accuracy relative to a benchmark. There are a number of forecasting accuracy metrics,¹ each with unique strengths and weaknesses, as discussed below.

- **Mean percentage error (MPE):** This is a simple average of the percentage errors in a given data set, incorporating both negative and positive observations. As a result, the indication reflects a combination of both forecasting accuracy and bias. Because of the netting effect created by

the inclusion of positive and negative datapoints, this measure will typically understate the true magnitude of the error.

- **Mean absolute percentage error (MAPE):** This measure quantifies the forecasting error for each observation by taking the absolute difference of the forecasted and actual realized amounts and dividing this number by the actual amount realized. Because it does not suffer from the netting effect present within the MPE, it is one of the most widely used methods to measure forecasting accuracy.
- **Median absolute percentage error (MdAPE):** This metric is similar to the MAPE, except a median value is used instead of the average. It offers many of the benefits of the MAPE but is less susceptible to impacts from large outliers.
- **Weighted mean absolute percentage error (WMAPE):** This metric is a volume-weighted version of the MAPE.

¹ The forecasting accuracy metrics discussed in this document are not a comprehensive list. We plan to discuss additional metrics in future editions of Analyzing Prospective Financial Information.

While each of the metrics above can provide useful insight into forecasting accuracy, we utilized the MdAPE in this document since it is easy to calculate, isolates forecasting accuracy from forecasting bias, and is not impacted by large outliers. The table on the following page illustrates how each of these metrics is calculated. For purposes of this illustration, the table includes actual and forecasted annual revenue metrics of a hypothetical subject company over a five-year period.

Year	Actual amount (A)	Forecasted amount (B)	Observed difference (C) [A-B]	Percent difference (D) [C/A]	Absolute difference (E)	Weighted abs error (F) [AxE]
2020	137.77	150.00	(12.23)	-8.9%	8.9%	12.23
2019	136.49	140.00	(3.51)	-2.6%	2.6%	3.51
2018	151.76	157.00	(5.24)	-3.5%	3.5%	5.24
2017	127.44	144.00	(16.56)	-13.0%	13.0%	16.56
2016	151.38	140.00	11.38	7.5%	7.5%	11.38
Total	704.84	731.00	(26.16)	-20.4%	35.4%	48.92

MPE	-20.4/5	=	-4.1%
MAPE	35.4/5	=	7.1%
MdAPE	Median of Column E	=	7.5%
WMAPE	48.92/704.84	=	6.9%



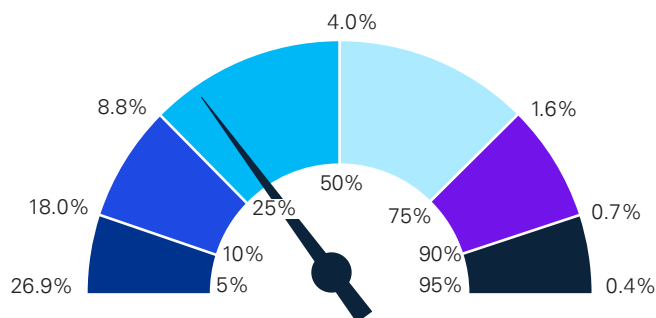
As we stated earlier, the MdAPE is more resistant to outliers compared to the MAPE. A simple example will demonstrate this. Suppose, in the table above, the actual amount for 2020 was 100 (instead of the 137.77). In this case, the MAPE would more than double to 15.3 percent whereas the MdAPE would remain unchanged at 7.5 percent.

Given the potential impact of outliers on our conclusions, we will be using the MdAPE when benchmarking forecasting accuracy in this document. More specifically, we calculated the MdAPE of the forecasted revenue, earnings before interest and taxes (EBIT), and earnings per share (EPS) for each of the companies within the S&P 500 over a five-year period² and compared these metrics with those of the hypothetical subject company. These comparisons are summarized in the following pages.

Forecasting accuracy benchmarking

Based on the results of the forecasting accuracy calculations, has the subject company been accurate with its historical forecasts? To evaluate the degree of accuracy, one must determine how the MdAPE of 7.5 percent compares to other companies over the same time period. In this example, we have assumed that an appropriate peer group for the subject company is the S&P 500.³ The hypothetical subject company's MdAPE of 7.5 percent for forecasted revenue would place the company's historical forecasting accuracy between the median (4.0 percent) and lower quartile (8.8 percent) observed for the S&P 500.

Absolute difference between forecasted and actual revenue (CY2016–CY2020)

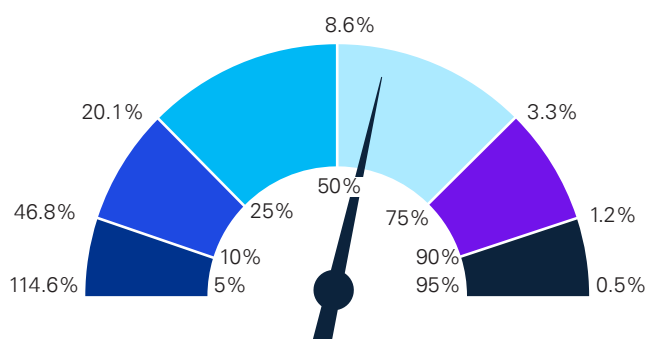


² The forecasted revenue, EBIT, and EPS were calculated as of the end of the prior calendar year (i.e., CY2020 forecasted revenue represents what was available as of 12/31/2019).

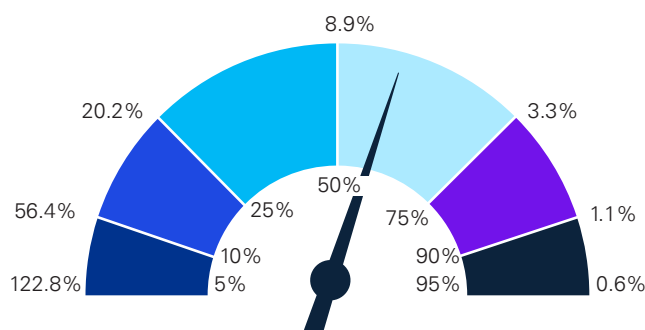
³ The S&P 500 benchmark is used for illustrative purposes only. Note that using the S&P 500 as a peer group should not be considered a best practice as forecasting accuracy varies significantly by industry. Due to the outliers that may be present within the S&P 500 benchmark, the comparisons made between the subject company and S&P 500 may not be statistically significant.

What if the 7.5 percent MdAPE above was for the subject company's EBIT or EPS forecasts? How would this compare to the S&P 500?

Absolute difference between forecasted and actual EBIT(CY2016–CY2020)



Absolute difference between forecasted and actual EPS (CY2016–CY2020)

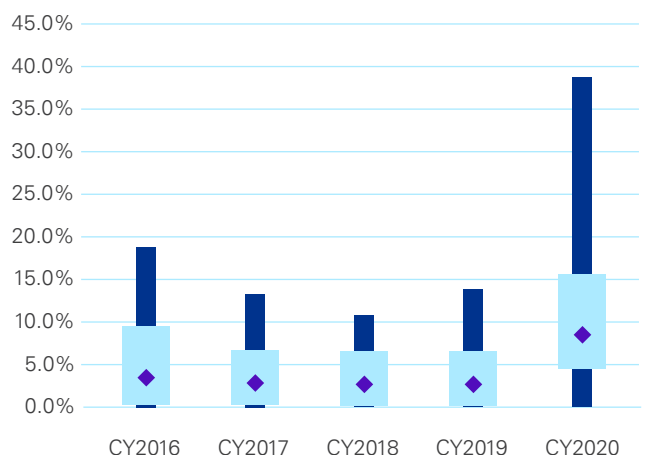


As shown above, if the 7.5 percent MdAPE pertained to the subject company's EBIT or EPS, rather than its revenue, the company would be viewed as performing slightly better than its S&P 500 benchmark in forecasting accuracy. The median, interquartile range, and outer deciles are higher for EBIT and EPS as compared to revenue. This lower degree of accuracy can be expected due to the increased volatility arising from the increased operating and financial leverage of these metrics.

Changes in forecasting accuracy of the S&P 500 over time

While the previous graphs provide a good perspective on forecasting accuracy over the recent past, it is important to consider the economic, industry, or other significant factors that can influence forecasting accuracy over time. The graph in the next column displays the median, interquartile range, and outer deciles for the annual absolute differences between analyst estimates and actuals of the S&P 500 companies.

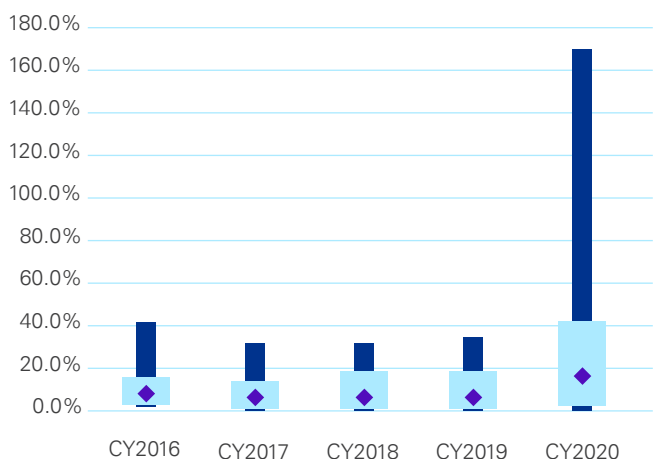
Absolute difference between revenue actuals and analyst estimates



10th to 90th percentile Median Interquartile range

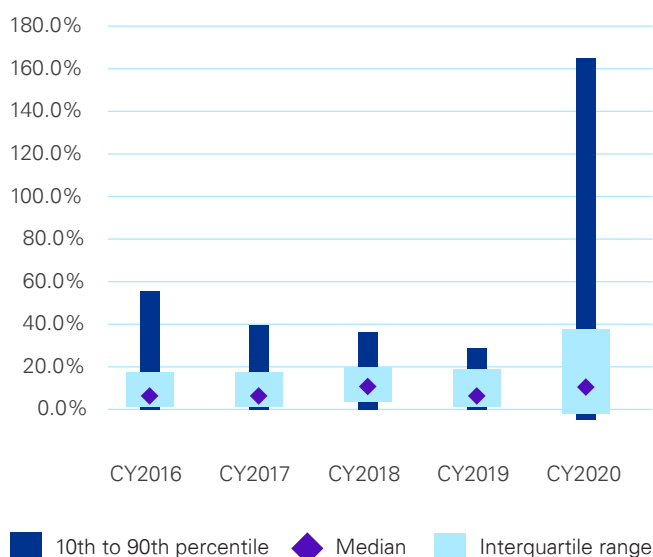
As shown above, the revenue MdAPE for the S&P 500 companies hovered slightly below five percent over the 2016-2019 period. The interquartile range was also fairly consistent. In 2020, revenue forecasting accuracy noticeably worsened, with the MdAPE more than doubling. Therefore, when assessing forecasting accuracy for 2020, it is important to limit the comparison to that year due to the impact of the COVID-19 pandemic on the economy. Similar trends were also observed for EBIT and EPS, as shown below.

Absolute difference between EBIT actuals and analyst estimates



10th to 90th percentile Median Interquartile range

Absolute difference between EPS actuals and analyst estimates



Other considerations

While the S&P 500 company comparisons can be informative, one should not use these metrics to assess forecasting accuracy. Instead, a peer group or industry comparison would be more appropriate as the targeted peer group would be exposed to similar industry and economic forces. Therefore, more meaningful conclusions could be drawn from the comparison.

In addition, the summary data included in this document provides a long-term view; however, the actual results can vary quite significantly year to year. In particular, the challenging environment in 2020 led to a significant decrease in forecasting accuracy. Therefore, the time period analyzed should be considered when setting up the study. Lastly, one must also pay attention to potential bias impacting the forecasts. While some of these topics were not discussed in this document, they will be covered in future editions of "Analyzing Prospective Financial Information."



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