INSTITUTIONAL ADVISORY & SOLUTIONS

Executive Summary

FORECASTING LONG-TERM EQUITY RETURNS:
A Comparison of Popular Methodologies

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Many investors need to make long-term asset class forecasts for planning and portfolio construction purposes. But despite considerable research on the topic, there continues to be a wide range of views on how to best generate the long-term equity return forecasts that CIOs use for their asset allocation decisions.

Some investors believe that equity markets are efficient and that future returns follow a random walk. If so, expected future returns are constant over time. While subsequent future realized returns will vary considerably, no information available today can help investors forecast future returns. For investors with this view, a long-term historical average return often serves as their constant return forecast.

Other investors believe, however, that expected future returns vary over time, conditional on some measure of current market valuation or market outlook. For example, when the market is "richly valued," future returns are likely to be lower than average, and vice versa. In other words, there is some limited ability to predict future market returns.

To analyze this issue, PGIM's IAS team evaluated the out-of-sample historical performance of two common methodologies for estimating 10-year equity market returns:

- A regression methodology using CAPE (the cyclically adjusted price-to-earnings ratio), and
- A more traditional "building block" (BBA) approach

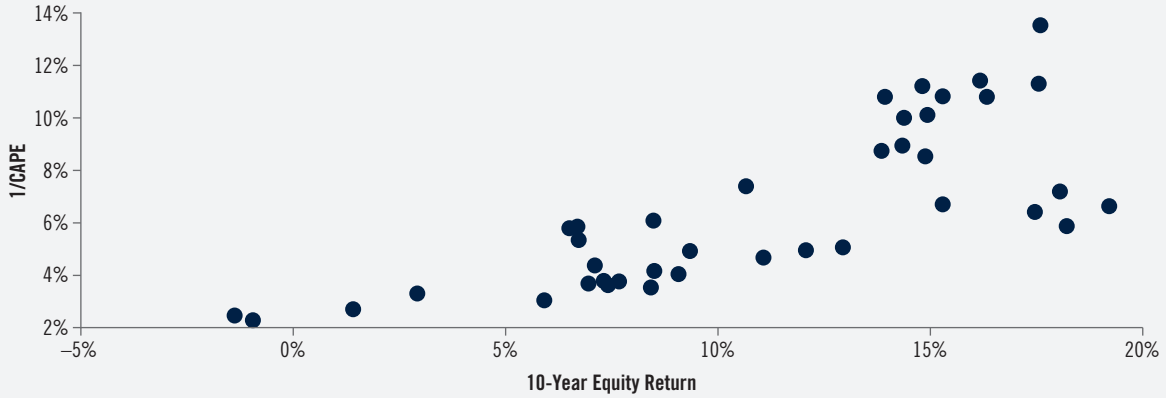
CAPE Approach (Regression-based)

Campbell and Shiller (1998)[1] found the ratio of the real stock market price divided by the 10-year average of inflation-adjusted earnings – which they called the cyclically adjusted price-to-earnings ratio (CAPE) – to have a strong empirical relationship with subsequent equity returns. This finding relates back to the fundamentals of stock market valuation and is supported by both theory and empirical evidence. Valuation ratios have been observed to fluctuate within a range, so if the CAPE ratio is at the higher end of its range then either future prices must fall or future earnings must rise. If earnings are relatively stable over time, then it would be reasonable to expect that when CAPE is high compared to its historical range, prices will eventually fall to restore the valuation ratio back to more normal values.

1 Campbell, John and Shiller, Robert. "Valuation Ratios and the Long Run Stock Market Outlook." *The Journal of Portfolio Management,* Vol. 24, No. 2. 1998. 11–16.

The findings shown are derived from statistical models. Reasonable people may disagree about the appropriate model and assumptions. Models should not be relied upon to make predictions of actual future account performance. See additional disclosures.

Figure 1: 10-Year Returns and CAPE (inverted) – 1970-2008



Source: Datastream, Online Data-Robert Shiller and PGIM IAS. Provided for illustrative purposes only.

For equity total returns we use S&P 500 index total returns (from Datastream) and obtain CAPE data from 1970–2008 from Shiller's online database. Figure 1 provides a scatterplot of 1/CAPE and subsequent future equity returns. We see that, generally, when 1/CAPE is low (*i.e.,* CAPE is high and the market is relatively "overvalued"), 10-year ahead equity returns appear to be low and vice versa. However, while this scatter plot suggests a strong empirical relationship between the two variables, it does not necessarily signal that there is a predictive relationship. To get a sense for why there might not be a strong predictive relationship note that 1/CAPE values of approximately 6% have been associated with both relatively low returns (6.7%) and high returns (18.2%). This wide range of equity market returns associated with similar CAPE values raises questions about CAPE's predictive power and its use for asset allocation.

It is important to highlight that Campbell and Shiller reported a long-term empirical relationship (*i.e.,* the result was "in-sample"). They did not analyze the ability of CAPE to predict returns (*i.e.,* "out-of-sample" performance). Based on the CAPE range from 1970–2008, some beginning-of-10-year period mid-CAPE values have produced better 10-year equity returns than the best return from a low-CAPE value. Likewise, the high-CAPE values have produced some 10-year returns similar to those for the mid-CAPE values. Therefore, high-CAPE values sometimes correspond to low 10-year equity returns, while low and mid-CAPE values are relatively uninformative in terms of future 10-year equity returns. So, despite the general average inverse relationship between CAPE and subsequent equity returns, it is an open question whether CAPE has much predictive power. Nevertheless, since its publication, the in-sample empirical relationship between CAPE and subsequent equity returns has been widely-publicized as a guide for long-term stock market forecasting.

Building Block Approach

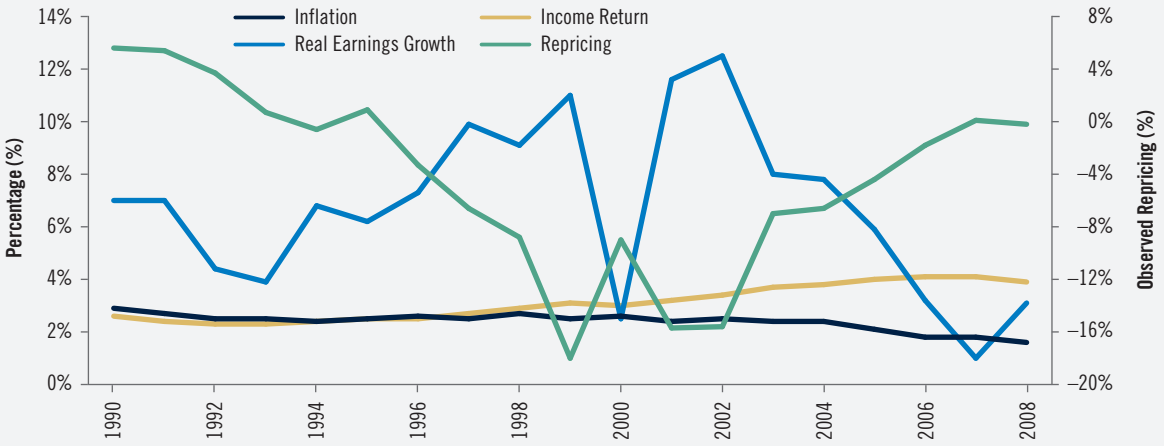
The building block approach (BBA) is probably the most common institutional methodology for estimating long-term asset class returns. Following a decomposition of equity returns into its components, the BBA approach estimates each component using forecasts and historical information to construct an asset class's expected return. Ibbotson and Siegel (1988)[2] proposed the first precursor to the modern BBA approach by stacking various risk premiums – "blocks" representing components of returns – to derive an estimate of future equity returns. By providing forward-looking estimates for each of these building blocks, one can generate a prediction for future equity total returns. Theoretically, if the estimates are accurate then we will have correctly predicted future equity returns. However, in providing estimates, we often introduce subjectivity into the BBA forecast and its predictive ability is only as good as the quality and suitability of our inputs. Consequently, although the building block methodology is widely used by investors, the variety of possible assumptions and inputs can lead to a wide range of equity market forecasts across investors.

We propose estimators for each of the building block components. Figure 2 shows several components of the actual 10-year equity market (S&P 500) total returns from 1990 to 2008. Observed 10-year inflation, real earnings growth, and income return are plotted on the left axis and the "observed repricing" component (any adjustment to returns not explained by the other three blocks) is plotted on the right axis. We see that the noisiest component of returns has been the repricing block, followed by real earnings growth. Inflation and the income return have remained relatively stable.

We then measure how well the BBA approach has performed (with or without the repricing component) as a predictor of 10-year equity market returns. Just as for the CAPE approach, we avoid any look-ahead bias and only use available contemporaneous data to estimate each building block and to generate equity market forecasts.

2 Ibbotson, Roger G., and Laurence B. Siegel. 1988. "How to Forecast Long-Run Asset Returns." *Investment Management Review,* (September/October).

Figure 2: 10-Year Equity Return Components (Actual) – 1990-2008, beginning of 10-year period



Source: Datastream, FRED and PGIM IAS. Provided for illustrative purposes only.

Analysis of Results

Using both the BBA and CAPE methodologies, we produce historical predictions for 10-year equity returns. Using root mean squared error (RMSE) as the metric of prediction ability, where a lower RMSE value indicates lower prediction error and, therefore, a better forecaster, we see that BBA with or without the repricing component has performed the best, with RMSE values of 3.7% and 4.5%, respectively.

CAPE's historical goodness-of-fit does not translate into a superior ability to directly forecast future non-observed returns. We find that extreme values of CAPE often persist before market returns change, making it difficult for CAPE alone to accurately forecast long-term equity returns – supporting the view that a relatively "extreme" CAPE value is not necessarily reason for dramatically altering asset allocation.

The "building block" approach, which utilizes macroeconomic forecasts based on history and extreme changes in P/E as a signal for valuation adjustment, proved to be a better forecaster than CAPE. However, given its remarkable stability, our BBA forecast does not seem to factor the prevailing market valuation environment into return prediction. The BBA approach with a repricing component performed especially well in periods of poor equity returns.

Figure 3: Estimated Returns and Actual Returns; Different Forecasting Methodologies - 1990–2008; beginning of each 10-year period

	CAPE-r	CAPE-e	BBA-rp	BBA-n	Hist-10	Hist-e	Random	Actual
Average	11.80%	8.00%	8.10%	8.80%	14.00%	12.10%	13.50%	8.00%
StDev	3.80%	2.20%	2.60%	1.00%	3.80%	0.90%	4.50%	5.20%
RMSE	9.1%	5.6%	3.7%	4.5%	9.0%	7.0%	9.2%	

Source: Datastream, Online Data-Robert Shiller, and PGIM IAS. Provided for illustrative purposes only.

Conclusion

Our results suggest that the forward-looking approach of a BBA methodology with carefully estimated components provides better forecasts than a regression-based CAPE method. If an investor plans to use a methodology that over time will prove more accurate, then the historical record is more supportive of the BBA approach, with or without a repricing component based on current P/E.

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