Swedroe: Passive Investing's Foundations

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Building upon the work of Harry Markowitz, the trio of John Lintner, William Sharpe and Jack Treynor are generally given most of the credit for introducing the first formal asset pricing model, the capital asset pricing model (CAPM). It was developed in the early 1960s.

The CAPM provided the first precise definition of risk and how it drives expected returns. Another benefit of the CAPM, and of later asset-pricing models as well, is that it allowed us to understand if an active manager who outperforms the market has generated alpha, or whether that outperformance could be explained by exposure to some factor.

The CAPM looks at risk and return through a "one-factor" lens—the risk and the return of a portfolio are determined only by its exposure to market beta. This beta is the measure of the equity-type risk of a stock, mutual fund or portfolio relative to the risk of the overall market.

The CAPM was the financial world's operating model for about 30 years.

However, like all models, it was by definition flawed or wrong. If such models were perfectly correct, they would be laws, like we have in physics. Over time, anomalies that contradicted the CAPM began to surface. The model, researchers found, was only able to explain about two-thirds of the differences in returns between diversified portfolios.

Among the biggest problems for the model were issues related to size and value. Academics were publishing papers showing that small-cap and value stocks were outperforming, even after accounting for their higher betas.

Fama-French And Beyond

For example, in a 1992 paper, Eugene Fama and Ken French proposed that, along with the market factor of beta, exposure to the factors of size and value explain the cross section of expected stock returns. The Fama-French model greatly improved upon the explanatory power of the CAPM, accounting for more than 90 percent of the differences in returns between diversified portfolios. However, there were still some significant anomalies, with momentum being perhaps the most important.

In 1997, Mark Carhart—in his study, "On Persistence in Mutual Fund Performance"—was the first to use momentum, together with the Fama-French factors, to explain mutual fund returns. The addition of momentum to the model further improved its explanatory power.

As a result, the new four-factor model—beta, size, value and momentum—became the standard tool used to analyze and explain the performance of investment managers and investment strategies.

However, there still remained a number of anomalies that the four-factor model could not adequately explain.

The Latest Research

Kewei Hou, Chen Xue and Lu Zhang—the authors of the 2012 study, "Digesting Anomalies: An Investment Approach"—proposed yet another four-factor model, one that went a long way toward explaining many of the anomalies that neither the Fama-French three-factor, nor the Carhart four-factor, models could.

The authors updated their study in October 2014, and the paper was accepted for publication in the Review of Financial Studies. The study now covers the period from 1972 through 2012.

The authors called their model the *q*-factor model. Its four factors are:

- *The market excess return (beta).*
- *The difference between the return on a portfolio of small-cap stocks and the return on a portfolio of large-cap stocks.* The size factor earned an average return of 0.31 percent per month with a t-stat of 2.12.
- *The difference between the return on a portfolio of low-investment stocks and the return on a portfolio of high-investment stocks.* The authors write: "Intuitively, investment predicts returns because given expected cash flows, high costs of capital imply low net present values of new capital and low investment, and low costs of capital imply high present values of new capital and high investment." They noted that the investment factor is highly correlated (0.69) with the value premium, suggesting that it plays a similar role to that of the value factor. The investment factor earned an average return of 0.45 percent per month with a t-stat of 4.95.
- *The difference between the return on a portfolio of high return-on-equity (ROE) stocks and the return on a portfolio of low return-on-equity stocks.* They write: "ROE predicts returns because high expected ROE relative to low

investment must imply high discount rates. The high discount rates are necessary to offset the high expected ROE to induce low net present values of new capital and low investment." The profitability factor earned an average return of 0.58 percent per month with a t-stat of 4.81. The authors noted that the profitability factor has a high correlation (0.50) with the momentum factor, and it plays a similar role as the momentum factor in analyzing performance.

Uncorrelated Factors

The authors found, importantly, that the investment and profitability factors are almost totally uncorrelated, meaning they are independent, or unique, factors. They also found the alphas of the value (high minus low (HML)) and momentum (up minus down) factors in the *q*-factor model are small and insignificant, their roles having been replaced by the investment and profitability factors.

Finally, the authors found that the *q*-factor model outperforms the Fama-French three-factor and four-factor models in its ability to explain the majority of anomalies. Most of the anomalies become insignificant at the 5 percent level of statistical significance. In other words, "many anomalies are basically different manifestations of the investment and ROE effects."

Given the importance of the issue of data mining, the investment and profitability factors had t-stats of close to five—they're highly significant. And while the t-stat of the size factor was lower at just more than 2, including it helps the *q*-factor model fit average returns across the size deciles.

Finally, the authors acknowledge that "the *q*-factor model is by no means perfect in capturing all the anomalies." Like all models, even the *q*-factor model is "flawed." But it does seem that this new model has advanced our understanding of how markets set prices.

Fama And French Examine The Q-Model

Professors Fama and French—in a November 2013 paper, "A Five-Factor Asset Pricing Model"—closely examined the *q*-factor model to determine whether its two new factors (investment and profitability) added explanatory power.

In other words, if Fama and French knew in 1993 what they know today, which model would they have chosen? The following is a summary of their findings:

- While a five-factor model (beta, size, value, profitability and investment) doesn't fully explain the cross section of returns (there are still anomalies) it does provide a good description of average returns.
- The model's main problem is its failure to explain the low average returns on small stocks of companies that invest a lot despite low profitability. It's interesting to note here that the Fama-French three-factor model has a problem explaining the poor performance of small growth stocks.
- The performance of the model isn't sensitive to the specifics of the way its factors are defined.
- A four-factor model that excludes the value factor (HML) captures average returns as well as any other four-factor model they considered. A five-factor model (including HML) doesn't improve the description of average returns over the four-factor model. The reason is that average HML returns are captured by the exposures to HML of other factors. Thus, in the five-factor model, HML is redundant for explaining average returns.

Finer Observations

Fama and French did observe that "while the five-factor model doesn't improve the description of average returns of the four-factor model that drops HML, the five-factor model may be a better choice in applications. For example, though captured by

exposures to other factors, there is a large-value premium in average returns that is often targeted by money managers."

Thus, "in evaluating how investment performance relates to known premiums, we probably want to know the tilts of the portfolios toward each of the factors."

They added that "for explaining average returns, nothing is lost in using a redundant factor." Importantly, they also found that the five-factor model performs well. They write: "Unexplained average returns for individual portfolios are almost all close to zero."

Noteworthy Findings

Among their other interesting findings, Fama and French discovered that "controlling for investment, value stocks behave like stocks with robust profitability, even though unconditionally value stocks tend to be less profitable."

They also found that the value, profitability and investment factors are negatively correlated with both the market and the size factor, providing important information regarding the potential benefits from portfolios that diversify exposure across factors.

In addition, Fama and French found that "the lethal combination for microcaps is low profitability and high investment; low profitability alone doesn't appear to be a problem." However, they also concluded that this problem doesn't hold for large stocks with low profitability and high investment. Note that passive portfolios can benefit from this knowledge by simply screening out stocks with these characteristics.

Furthermore, with this new model, momentum isn't needed to explain the variation in returns of diversified portfolios, just as the well-known value factor isn't required either.

Returning to the question we posed earlier, knowing what we know today, which

model would they have chosen?

Fama and French concluded that, since HML seems to be a redundant factor in the sense that its high average return is fully captured by its exposure to other factors, in "applications where the sole interest is abnormal returns our tests suggest that a four-factor model that drops HML performs as well as (no better and no worse than) the five-factor model. But if one is also interested in measuring portfolio tilts toward value, profitability, and investment, the five-factor model is the choice."

Final Takeaways

Only time will tell if the new model replaces the Fama-French model. However, with their endorsement, it does seem like a good possibility.

In summary, Kewei Hou, Chen Xue and Lu Zhang believe that the *q*-factor model's performance—combined with its clear economic intuition—suggests it can be used in practical applications, such as evaluating mutual fund performance, measuring abnormal returns in event studies, estimating costs of capital for capital budgeting and stock valuation, and obtaining expected return estimates for optimal portfolio choice.

Investment companies can also use it to adjust the structure of the financial products they offer to investors, going beyond traditional styles such as size and book-to-market. While we have seen investment products focus on the profitability factor, as of yet, I'm not aware of any products that are focused on the investment factor.

Stay tuned.

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