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jpm.iijournals.com

QUANTITATIVE STRATEGIES: *FACTOR INVESTING*

THIRD EDITION 2018

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Fama and French [2015] proposed a new five-factor asset pricing model, which succeeded their highly influential (Fama and French [1993]) three-factor model. The three-factor model has strongly shaped thinking about asset pricing for more than 20 years, and every finance student is required to know and understand the model. Calculating alphas using the three-factor model has become standard practice in the asset pricing literature. Professor Fama even received the Nobel Prize in Economics for his contributions to this field. The new Fama and French model aims to explain some prominent and pervasive patterns in the cross section of stock returns that their three-factor model could not. The authors do not proclaim their new model to be the last word on asset pricing or suggest that it fully explains stock returns, but, for practical purposes, the five-factor model is likely to become the new benchmark in asset pricing in the years to come.

The three-factor model was inspired by Fama and French [1992], who found strong evidence for the existence of size and value premiums in the cross section of stock returns. Fama and French [1993] argued that these factors capture a dimension of systematic risk that is not captured by market beta in the capital asset pricing model (CAPM) and proposed to extend the CAPM with size (small minus big [SMB]) and value (high minus low [HML]) factors, resulting in a three-factor model. Since then, it has become common practice in the asset pricing literature to report not only one-factor alphas but also three-factor alphas. However, many such studies report three-factor alphas that are significantly different from zero, which suggests that the three-factor model is incomplete and that more factors are needed to accurately describe the cross section of stock returns.

Inspired by the mounting evidence that three factors will not suffice, Fama and French [2015] proposed augmenting their three-factor model with two additional factors, namely profitability (robust minus weak [RMW]) and investment (conservative minus aggressive [CMA]). This new five-factor model significantly raises the bar for new anomalies. Fama and French [2016a] argued that it effectively addresses the main shortcomings of the three-factor model.

We fully acknowledge that the five-factor model represents a significant step forward compared to the three-factor model, however, we argue that the five-factor model also raises many questions. More specifically, we discuss five concerns with regard to the new model.

Our first concern is that, similar to the three-factor model, the five-factor model retains the CAPM relation between market beta and return. This helps to explain the equity risk premium but also implies that a higher market beta should, ceteris paribus, result in a higher expected return. This assumption contradicts the existence of a low-beta or low-volatility premium, despite a wide body of literature showing otherwise. Fama and French [2016a] addressed this issue and argued that, in fact, the low-beta anomaly is largely resolved by their five-factor model. However, this conclusion is premature because direct evidence that a higher market beta exposure is rewarded with higher returns is still conspicuously absent.

Our second concern is that, similar to the three-factor model, the five-factor model is unable to explain the momentum premium and continues to ignore it. Because momentum is too pervasive and important to ignore, most studies report not only three-factor alphas but also four-factor alphas, based on the three-factor model augmented with a momentum factor (winners minus losers [WML]). For the same reason, many researchers will feel the need to augment the five-factor model with a momentum factor, resulting in a six-factor model. However, even asset pricing models that include the standard momentum factor are unable to explain the related idiosyncratic momentum phenomenon documented by Gutierrez and Pirinsky [2007], as shown by Blitz, Hanauer, and Vidojevic [2018].

Our third concern is the robustness of the two new factors chosen by Fama and French [2015]. Particularly surprising is that the investment factor is defined as asset growth, which they considered to be a "less robust" phenomenon in their earlier work (Fama and French [2008]). More specifically, the five-factor model fails to explain a number of variables that are closely related to the two selected ones. Other robustness concerns are that it is still unclear whether the two new factors are effective before 1963, as discussed by Linnainmaa and Roberts [2018], and whether they also exist within other asset classes.

Our fourth concern is the economic rationale for the new model. Fama and French [1993, 1996] justified the addition of size and value factors by arguing that these could be seen as priced risk factors, hinting at the possibility that they might capture the risk of financial distress. Since then, studies such as those by Dichev [1998], Griffin and Lemmon [2002], and Campbell, Hilscher, and Szilagyi [2008], have shown that the direct relation between distress risk and return is actually negative, which is consistent with the existence of a low-risk premium. For the two new factors in the five-factor model, Fama and French did not even attempt to explain that these are plausible risk factors. Instead, their motivation for inclusion of these factors is to proxy expected returns, which they derive from a rewritten dividend discount model (DDM). It remains unclear, though, if the higher expected returns for firms with high profitability or low investment, all else constant, are due to higher (distress) risk or mispricing. If the goal were to simply construct a model that fits the data best without the need to rationalize the chosen factors, the five-factor model does a pretty good job (apart from the concerns discussed), but this is not the motivation for the model.

Our fifth and last concern is that the five-factor model is probably not going to put an end to empirical asset pricing discussions or lead to consensus. For instance, the classic size and value factors are still being challenged; the size premium seems to have dwindled after it was first documented in the early 1980s, and the HML value factor is also known to have robustness issues, especially in the large-cap segment of the market. Furthermore, there is a lack of consensus that the five-factor model is the ultimate asset pricing model, and alternative, competing models are already out there (see, e.g., Hou, Xue, and Zhang [2015, 2016]). Finally, just as many studies have documented asset pricing anomalies with significant three- and four-factor alphas over the last two decades, we expect that in the years ahead many studies will appear that document anomalies with significant three-, four-, five-, and six-factor alphas.

In the following sections, we discuss each of these five concerns in more detail. We conclude that, although the five-factor model represents a major step forward in the empirical asset pricing literature, it is not going to settle the asset pricing debate. It may well turn out to raise more questions than it answers.

CONCERN 1: THE LOW-RISK ANOMALY

Our first concern with the five-factor model is that, similar to the three-factor model, it retains the fundamental CAPM relation between market beta and return. Using the CAPM as a starting point for an asset pricing model is appealing for various reasons. First, the CAPM has strong theoretical underpinnings. Second, it helps to explain the equity risk premium (i.e., why stocks on average have a return that is higher than the risk-free return). This argument was also used by Fama and French [1993] in the context of their three-factor model. Third, the CAPM is very effective at explaining the time-series variation in stock returns because when the market goes up (down), high-beta stocks tend to go up (down) more, whereas low-beta stocks tend go up (down) less.

Crucially, however, the CAPM also implies that a higher market beta should, ceteris paribus, be rewarded with a higher expected return in the cross section of stocks. This assumption denies the existence of a low-beta anomaly. The first empirical tests of the CAPM by Black, Jensen, and Scholes [1972] and Fama and MacBeth [1973] already revealed a flatter relation between market beta and return than predicted by the model, whereas Haugen and Heins [1975] even found a negative relation. Two decades later, Fama and French [1992] themselves concluded that, when controlling for size effects, market beta is unpriced in the cross section of stock returns. Blitz and van Vliet [2007] showed that the low-beta effect has not just persisted but rather has become more pronounced over time, that the effect is even stronger when volatility is used instead of beta, and that the effect is also strongly present in international equity markets. More recent studies, such as those by Baker, Bradley, and Wurgler [2011]; Baker and Haugen [2012]; and Frazzini and Pedersen [2014], confirm the low-volatility and/or low-beta effects.

The five-factor model postulates a positive, linear relationship between factor loadings (i.e., betas) and expected stock returns. This means that, if one properly accounts for the size, value, profitability, and investment factors, long-term average returns should increase with market betas. Essentially, the original CAPM is a nested version of the five-factor model, in which additional factors are added to aid market beta in explaining the cross section. This is, after all, the most widely accepted factor with the highest variance that is not spanned by the other factors. That said, its inclusion in the five-factor model, which aims to explain the cross section of returns, is questionable given the lack of empirical support for the claim that returns increase with market betas. Fama and French [2016a] justified the CAPM basis of their model by showing that the low-beta anomaly is largely explained by their five-factor model. This result is in line with that of Novy-Marx [2014], who found that the low-beta and low-volatility effects are explained by the three-factor model augmented with a profitability factor. Both studies used time-series regressions to come to these conclusions.

Blitz and Vidojevic [2017] took a closer look at these results. They observed that direct evidence for a linear, positive relation between market beta and returns, which is assumed in the models of Fama and French and Novy-Marx, is still lacking and, therefore, that it is premature to conclude that the low-risk anomaly is explained. More specifically, if the Fama and French [2015] asset pricing model were correct, it should be possible to construct portfolios that show that the predicted linear relation between market beta and returns holds in practice, provided one controls appropriately for the other factors in the model. Blitz and Vidojevic [2017] tested whether this premise is supported by the data using Fama and MacBeth's [1973] regressions, in which the estimated coefficients can be interpreted as returns on portfolios that have unit exposure (ex ante) to one specific factor, controlling for the exposures (ex ante) to all other factors included in the regression. They found that all factors in the five-factor model are rewarded with significant premiums, except the market beta. In other words, a unit exposure to market beta in the cross section does not result in significantly higher returns, regardless of whether one controls for the other factors in the five-factor model. They further modified the testing procedure and went on to show that the magnitude of the deviation from the theoretical relationship is significant. They also observed stronger mispricing for volatility than for beta, which suggests that the low-volatility effect is the dominant phenomenon. Taken together, these results imply that the relation between risk and return in the cross section is flat instead of positive (i.e., there still exists a major low-risk anomaly).

This does not mean that we advocate the addition of a low-versus-high beta (or low-versus-high volatility) factor to asset pricing models based on the CAPM; a model that starts by assuming the CAPM relation and then adds a factor with the sole purpose of altering that relation would be internally inconsistent. Instead, we question whether the CAPM should be used as the basis for an asset pricing model in the first place. Ideally, an asset pricing model should be able to explain the existence of an equity risk premium, but also allow for the absence of a return premium to market beta exposure in the cross section that is observed in practice.

CONCERN 2: MOMENTUM

Although the empirical evidence for the momentum premium documented by Jegadeesh and Titman [1993] is as strong as that for the size and value premiums, Fama and French [1993] did not include it in their three-factor model. This might be because the three-factor model was developed around the same time that the momentum phenomenon became known. A more fundamental problem with adding momentum to the three-factor model is that it is hard to argue that, similar to the other factors in the model, it can be seen as a priced risk factor (see also concern 4). However, the momentum premium has turned out to be too "pervasive" (Fama and French [2008, p. 1653]) and strong to simply ignore and is, by now, an established factor. The four-factor model (i.e., the three-factor model augmented with a momentum factor) is as popular in the asset pricing literature as the three-factor model.

Interestingly, however, the momentum factor is still conspicuously absent in the five-factor model, despite the clear opportunity this presented to include it once and for all. Fama and French [2016a] acknowledged that, similar to the three-factor model, the five-factor model is unable to explain the momentum effect. They also mentioned that the focus of the model is on explaining long-term expected returns rather than short-term variation in returns. We are surprised that momentum continues to be ignored in this way, despite the abundant evidence for the momentum phenomenon. We expect that many studies will prefer to use a six-factor model—that is, the five-factor model augmented with the same momentum factor that is commonly used to transform the three-factor model into a four-factor model.

The momentum phenomenon raises more asset pricing questions, though. Gutierrez and Pirinsky [2007] considered a momentum strategy in which stocks are sorted on their idiosyncratic returns (i.e., the stock-specific residual returns that follow from regressions of total stock returns on the three-factor model). Blitz, Huij, and Martens [2011] showed that the risk-adjusted return of this idiosyncratic momentum strategy is double that of the conventional momentum strategy. Blitz, Hanauer, and Vidojevic [2018] went on to show that idiosyncratic momentum is a distinct phenomenon. Using a set of time-series, cross-section, and factor-spanning tests, they showed that idiosyncratic momentum can be explained neither by the five-factor model nor by the six-factor model consisting of the five-factor model plus the conventional momentum factor. In other words, the conventional momentum effect cannot explain the idiosyncratic momentum effect. They concluded that idiosyncratic momentum presents an even bigger challenge to the asset pricing literature.

CONCERN 3: ROBUSTNESS OF NEW FACTORS

Fama and French [2015] motivated their two new factors, profitability and investment, using a rewritten DDM. For a given level of book-to-market and investment, higher future profitability implies higher expected returns, and for a given level of book-to-market and profitability, low investment also imply higher expected returns. It remains unclear, though, which *current* variables best proxy *future* firm characteristics. Interestingly, the investment factor in the five-factor model is defined as asset growth, although Fama and French [2008] themselves concluded that asset growth is not sufficiently robust. In the same paper, they found better results for net share issuance, and because that variable also happens to fit better with the DDM story, it would appear to be a stronger candidate for the investment factor in the five-factor model.

Fama and French [2008] also concluded that profitability is not a robust factor, but back then, they still relied on plain return on equity, which is a noisy proxy of future profitability. Novy-Marx [2013] proposed an alternative (gross) profitability factor, which better predicts future stock returns and future firm profitability. Fama and French [2015] used a similar measure of operating profitability (after interest costs), but it remains unclear whether such variables are the best proxies for future profitability. For instance, the accruals anomaly of Sloan [1996] is also related to future profitability, and Fama and French [2016a] showed that the five-factor model has problems explaining this factor. Ball et al. [2016] combined the insights of Sloan [1996] and Ball et al. [2015] to devise a cash-based operating profitability measure that dominates accruals-based operating profitability, a result that was confirmed by Fama and French [2016b]. According to Hou, Xue, and Zhang [2015], the five-factor model also fails to explain the net operating assets factor of Hirshleifer et al. [2004]. In short, it seems that there are factors that may be preferred over those chosen by Fama and French [2015] for inclusion in their five-factor model. We do note that the Fama and French [2015] definition of profitability has the advantage of being available for all stocks, unlike some of the alternatives that have been proposed, which are undefined for financials.

Another robustness concern is the out-of-sample performance of the two new factors. More-established factors, such as value and momentum, are known to have remained effective after they became first known. They have also been shown to be effective in earlier samples and other markets, and are even known to carry over to other classes. It is still unclear, however, whether the relatively new profitability and investment factors will prove to be equally persistent. Pontiff and Woodgate [2008] examined the performance of net share issuance over the entire CRSP sample period and concluded that this investment factor is powerful post-1970 but ineffective pre-1970. This observation might be explained by the enactment of Securities and Exchange Commission rule 10b-18 in 1982, which led to much higher share repurchase activities that directly affect net share issuance (see Boudoukh et al. [2007]). More recently, Linnainmaa and Roberts [2018] tested the two new Fama–French factors over the early decades in the CRSP database and concluded that "investment and profitability premiums are largely absent from the cross section of stock returns before 1963."

CONCERN 4: ECONOMIC RATIONALE

Fama and French [1993, 1996] still interpreted size and value as priced risk factors, hinting at the possibility that they might be related to the risk of financial distress. In other words, the idea behind the three-factor model was that the CAPM is fundamentally right, in the sense that systematically higher returns can only be obtained with higher systematic risk, but apparently size and value capture a dimension of systematic risk that plain CAPM market beta does not. This view was soon challenged—for example, by Lakonishok, Shleifer, and Vishny [1994], who argued that value strategies are not particularly risky and that, instead, their return seems to stem from behavioral biases of investors, in particular extrapolation of past growth into the future. Another problem with the distress risk argument is that studies that examine direct indicators for distress risk find a negative relation with subsequent returns (e.g., Dichev [1998]; Griffin and Lemmon [2002]; and Campbell, Hilscher, and Szilagyi [2008]). These findings are consistent with the existence of a low-risk premium.

Interestingly, Fama and French [2015] no longer justified the addition of the two new factors in their five-factor model by providing an explicit risk-based explanation, perhaps because they realized that risk-based explanations would not be very plausible for the new factors. They did refer to the intertemporal CAPM, in which the factors could proxy for unobserved state variables. However, from a risk-based perspective, one would expect (risky) low-profitability firms to outperform (safe) high-profitability firms, instead of the other way around. Cooper, Gulen, and Schill [2008] also favored behavioral explanations over risk-based explanations for the asset growth anomaly. If asset pricing factors no longer require a risk-based explanation, however, does that mean that suddenly every conceivable factor is eligible for inclusion in an asset pricing model? In that case, the challenge would merely be to identify the smallest set of factors that explains all factors out there that need to be explained. This would essentially turn the design of asset pricing models into a statistical data-fitting exercise.

However, this is also not how Fama and French seem to look at it. Instead, their justification for the factors in the five-factor model is based on rewriting the classic DDM. In this rewritten model, the two additional factors directly imply expected returns, next to the book-to-market ratio. We do not criticize the use of DDM as a model of expected stock returns; instead, we emphasize that this model does not say anything about the source of the factors—in particular, whether the observed premiums are compensations for systematic risks or behavioral anomalies. In other words, it remains unclear why, all else constant, investors would be willing to accept lower returns on firms with low profitability and high investment and why they would require higher returns for firms with high profitability and low investment. The fact that the five-factor model makes no statement about the source of factor premiums makes it a paradigm shift compared to the CAPM and three-factor model, which both had risk foundations.

We conclude that, if the goal were to simply construct a model that fits the data best, without the need to rationalize the chosen factors, the five-factor model actually does a pretty good job (apart from the concerns discussed). This is not how the model is motivated by Fama and French, though, and because the risk-based explanation also seems to have gone into the background, the economic rationale of the new model is unclear.

CONCERN 5: THE ASSET PRICING DEBATE WILL RAGE ON

With the three-factor model, Fama and French [1993] brought some order to the asset pricing chaos that had arisen in the early 1990s. For a while, it seemed that all the anomalies that had popped up, except for momentum and short-term reversal (see, e.g., Fama and French [1996]), could be brought back to three factors, and the risk-based interpretations of these factors meant that the CAPM did not need to abandoned but instead could be salvaged with a bit of modification. Since then, it has become clear that more factors are needed to adequately describe the cross section of stock returns; for many, if not all, of these factors, behavioral explanations seem as plausible as risk-based explanations. Modifying the three-factor model was an opportunity to, once again, bring order to the chaos. The five-factor model does so by explicitly addressing the profitability and investment anomalies that the three-factor model is unable to explain, and in that sense, it represents a significant step forward. However, it does not seem likely that the five-factor model is going to put an end to ongoing asset pricing discussions. The debate is likely to rage on, and the five-factor model might even end up raising more questions than it answers. Consensus is not in sight.

To start, the original size and value factors are still being challenged. The size premium seems to have dwindled after it was first documented in the early 1980s, and it is not very robust in international equity markets (see, e.g., van Dijk [2011]). The HML value factor of Fama and French also has robustness issues, as pointed out by Ang and Chen [2007] for the pre-1963 period and by Loughran [1997] for the large-cap segment. Fama and French [2006] showed that their value factor failed to deliver a significant CAPM-adjusted premium in the large-cap segment of the market over the last 80 years, and Blitz [2016] found that HML did not even generate a raw return premium in the large-cap segment of the market over the last 30 years. More recently, Fama and French [2015] observed that the HML value factor is rendered redundant by the other factors in the five-factor model, although Asness et al. [2015] argued that a modified version of HML, which does not relate the book value of a firm to its lagged market value but rather to its most recent market value, remains a highly significant factor that is not explained by other factors.

It is also still unclear to what extent the five-factor model can explain the large number of factors that could not be explained by the three-factor model. Harvey, Liu, and Zhu [2016] listed hundreds of factors, but Fama and French [2015] only investigated the ability of the five-factor model to explain returns on portfolios that are constructed as sorts on the very same characteristics that are used to construct their factors. Fama and French [2016a] examined the model's performance on a small number of other factors and found mixed results. It is also unclear whether the five-factor model does a better job of explaining industry portfolio returns, which were identified as a weak spot in the three-factor model by Lewellen, Nagel, and Shanken [2010]. We expect that the large number of studies that have documented asset pricing anomalies with significant three- and four-factor alphas will be followed in years to come by many more studies that document anomalies with significant three-, four-, five-, and six-factor alphas. The five-factor model is likely to struggle in particular at explaining short-term (fast-changing signals) anomalies because the model only contains long-term factors (slow-changing signals).

Finally, we observe a lack of consensus on regarding the five-factor model as the ultimate asset pricing model. For instance, Hou, Xue, and Zhang [2015] proposed an alternative asset pricing model containing only four factors and later showed (Hou, Xue, and Zhang [2016]) that this model is able to explain every factor in the five-factor model. They also raised a number of concerns that apply specifically to the five-factor model.

SUMMARY AND IMPLICATIONS

The new five-factor model of Fama and French [2015], which adds profitability and investment factors to their classic 1993 three-factor model, is likely to become the new benchmark for asset pricing studies. Although the five-factor model effectively addresses some of the limitations of its predecessor, we identify five concerns with regard to the new model. First, it continues to take the CAPM relation between market beta and return as a starting point, despite mounting evidence that market beta is not a priced in the cross section (i.e., the low-beta anomaly). Second, it continues to ignore one of the most pervasive and widely accepted asset pricing anomalies, namely the momentum effect. Third, there are a number of robustness concerns with regard to the two new factors. Fourth, the economic rationale for the two new factors is unclear because, whereas the factors in the three-factor model were argued to be priced risk factors, the five-factor model is motivated with a discounted dividend model. Fifth and finally, it does not seem likely that the five-factor model is going to settle the main asset pricing debates or lead to consensus.

What is the implication of these findings? We acknowledge that it is not easy to create an alternative asset pricing model that preserves the strengths of the five-factor model but also addresses our five concerns. The design of such a new model raises many questions. For instance, should market beta remain in the model to explain the short-term cross-sectional variation in stock returns, but without a return premium in the long run? What should be done with the classic size and value factors? How can momentum be incorporated in such a way that both conventional momentum and idiosyncratic momentum can be explained? Which definitions of profitability and investment are most powerful and robust? We hope this article inspires researchers to tackle these challenging questions.

ENDNOTE

The authors thank Laurens Swinkels for valuable comments.

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