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Risk adjustment and momentum sources

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ABSTRACT

We show that the conventional procedure of risk adjustment by running full-sample time-series Fama–French three-factor regressions is not appropriate for momentum portfolios because the procedure fails to allow for the systematic dynamics of momentum portfolio factor loadings. We propose a simple procedure to adjust risks associated with the Fama–French three factors for momentum portfolios. Using our proposed method, the Fama–French three factors can explain approximately 40% of momentum profits generated by individual stocks and nearly all of momentum returns from style portfolios.

1. Introduction

The profitability of momentum strategies is well documented since the work of Jegadeesh and Titman (1993). Buying the best-performing stocks and shorting the worst-performing ones during the past 3–12 months and holding the zero-cost portfolio for the subsequent 3–12 months can earn significant profits both in the US and international equity markets (Chan et al., 1996, 2000; Rouwenhorst, 1998; Balvers and Wu, 2006; Griffin et al., 2003). The profitability of such trading strategies is robust to sub-sample periods (Jegadeesh and Titman, 2001; Grundy and Martin, 2001). The issue under heated debate is, however, the sources of momentum. The dominant view is that momentum profits cannot be explained by popular asset pricing models, such as the capital asset pricing model (CAPM) or the Fama and French (1993) three-factor model (Fama and French, 1996; Grundy and Martin, 2001). Therefore, the stock price momentum is widely regarded as the most persistent asset pricing anomaly that poses a big challenge to the long-established efficient markets hypothesis and motivates researchers to explore behavioral explanations (Barberis et al., 1998; Daniel et al., 1998; Hong and Stein, 1999; Han and Grinblatt, 2005). Other authors, nevertheless, present evidence that momentum profits are rewards for assuming additional systematic risks and thus have nothing to do with market inefficiency, providing empirical support for theoretical models that associate momentum returns with fundamental risks (Conrad and Kaul, 1998; Berk et al., 1999; Harvey and Siddique, 2000; Chordia and Shivakumar, 2002, 2006; Johnson, 2002; Lewellen and Shanken, 2002; Avramov et al., 2007; Liu et al., 2008; Sagi and Seasholes, 2007).

Perhaps the most powerful evidence provided by the non-risk-based view is the inability of traditional asset pricing models to account for the momentum profitability. Adjusting momentum returns by either the CAPM or the Fama–French three-factor model does not reduce the returns; instead it strengthens the raw returns in most cases. However, as Fama (1970) puts it, any test of market efficiency involves the joint hypothesis problem. The test must assume an equilibrium asset pricing model that defines normal asset returns and the rejection of the null hypothesis may be due to either market inefficiency or misspecification of the assumed equilibrium model. The joint hypothesis problem motivates some researchers to experiment with alternative asset pricing specifications used for risk adjustment of momentum returns. For example, Ahn et al. (2003) use the stochastic discount factor estimated nonparametrically from a set of industry portfolios to account for the risks associated with momentum trading strategies. Wang (2003) constructs a nonparametric pricing kernel that represents a flexible form of the Fama–French three-factor model and uses the model to adjust momentum returns. Yao (2002) adopts a dynamic principal

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component method to extract latent factors from a cross-section of stock returns to account for the momentum profitability. Harvey and Siddique (2000) demonstrate that adding the conditional skewness to the Fama–French three-factor model helps explain momentum. These authors find that momentum strategies no longer earn significant abnormal returns if risks are adjusted by their alternative models, suggesting that momentum profits are a compensation for assuming systematic risks.[1]

This article is a new effort to unravel momentum sources in the direction of risk adjustment of momentum profits. Unlike the aforementioned recent studies, we do not pursue a new equilibrium model to adjust for risks; instead we focus on the most widely used linear Fama–French three-factor model. Numerous studies establish the connection of the Fama–French factors with the real fundamental risk exposures (Fama and French, 1995; Liew and Vassalou (2000); Brennan et al., 2004), so the use of this model can mitigate the potential data-mining or overfitting problems for the nonparametric or principal component techniques. We show that it is flawed to use the full-sample unconditional time-series regression of momentum portfolio returns on either excess market return or on Fama–French three factors to find the risk-adjusted momentum returns because the procedure ignores the dynamic nature of the factor loadings of momentum portfolios. Specifically, if we consider the Fama–French three-factor model as an appropriate equilibrium model for both individual stocks and portfolios, the winners should load much more heavily on the three factors than the losers when the factors earn positive premia on average during the ranking periods of momentum strategies and the reverse will be true when the factor premia are negative. If the factor premia are positively autocorrelated over ranking and holding periods, as is typically the case in reality, there should be some degree of positive covariation between the factor loadings of the winner-loser momentum portfolio and the contemporaneous factor premia. The conventional unconditional risk adjustment ignores the dynamic relationship between momentum portfolio factor loadings and factor premia by implicitly assuming that the factor betas are constant over time and consequently underestimating the contribution of the common risk factors to momentum profits. We propose a simple approach to allow for the dynamic nature of momentum portfolio betas by adjusting common risk factors at the individual stock level. Using our procedure, the risk-adjusted momentum returns are reduced uniformly and substantially for a variety of momentum strategies, albeit they remain statistically significant in most cases.

The fact that the Fama–French three factors cannot fully explain momentum profits under the proposed approach may suggest that both risk factors and behavioral factors play a role in the generation of momentum effect, but it could also be a result of the inadequacy of this model as an equilibrium model for the stocks that underlie momentum portfolios. For the latter possibility, momentum profits could be better accounted for if a more adequate model could be identified. We attempt to distinguish these two conjectures by comparing the difference in Fama–French three-factor-adjusted momentum returns between individual-stock-based momentum strategies and some portfolio-based momentum strategies, or the so-called style momentum explored by Barberis and Shleifer (2003). Contrary to the individual stock momentum, the profits from most style momentum strategies become both statistically and economically insignificant after they are adjusted for risks at the individual component portfolio level.

In related work, Wang (2002) implements Fama–French three-factor adjustment for style momentum returns by allowing for the dynamic nature of momentum portfolio betas (he calls "beta rotation") and finds that style momentum returns can be explained away by a properly designed adjustment scheme. Although both this article and Wang's paper aim at correcting for the same flaw committed in the previous literature, we focus on individual stock momentum and so our conclusion is more general. In addition, we make an effort to establish the link between the ability of an equilibrium model to capture momentum returns and its ability to explain the returns of the momentum-underlying stocks or portfolios.

The remainder of this paper is organized as follows. Section 2 describes the data. Section 3 proposes a simple risk adjustment procedure that allows for the systematic dynamics of factor loadings for momentum portfolios. This section also presents risk-adjusted profitability of individual stock momentum strategies. Section 4 presents risk-adjusted returns for style momentum strategies using our risk adjustment procedure and Section 5 concludes.

2. The data

This paper uses two sets of data. The first dataset includes the monthly returns for all the stocks listed in NYSE and AMEX over the period from January 1965 to December 2002, obtained from the CRSP monthly tape. We only consider all domestic primary stocks (CRSP share codes 10 and 11) and so closed-end funds, Real Estate Investment Trusts (REITs), trusts, American Depository Receipts (ADRs), and foreign stocks are excluded from the analysis. This dataset is comparable to the data used in many related studies, such as Fama and French (1996), Jegadeesh and Titman (1993, 2001), and Ahn et al. (2003). A total of 6640 stocks are used in the study. The number of stocks used in our momentum strategies for each month ranges from a minimum of 1820 to a maximum of 2370. The summary statistics for this dataset are provided in Panel A of Table 1, in which we also report the summary statistics for NYSE and AMEX equal-weighted and value-weighted market indices and the Fama–French three factors.[2] The annualized mean returns for individual stocks, the equal-weighted index, and the value-weighted index are 12%, 14%, and 10.8%, respectively, during the sample period. The average first-order autocorrelation in individual stock monthly returns is negative, while the first-order autocorrelations in equal-weighted and value-weighted market indices are both positive, a result consistent with the findings of Campbell et al. (1997). We also find that the first-order autocorrelations for the Fama–French three factor-mimicking portfolios are all positive and autocorrelations in the short and intermediate horizons (1–12 months) are mostly positive for the SMB portfolio and the HML portfolio, a finding that will be used in the following section. We run a time-series regression of the monthly returns for each stock in our sample on the contemporaneous Fama–French three factors and the results show that on average only about 25% of cross-sectional variations in monthly stock returns can be explained by the Fama–French three-factor model.

The other set of data we use in this article is the monthly returns for some characteristic-based stock portfolios over the period from January 1965 to December 2002. These portfolios include 30 industry portfolios based on four-digit SIC code, 10 size portfolios sorted by market capitalization of the universe of NYSE, AMEX, and NASDAQ stocks, and 25 size-B/M portfolios double-sorted by the market capitalization quintile and the book-to-market ratio quintile. The datasets are obtained from Kenneth French's website and the detailed descriptions about the construction of these

[1] Studies that strive to explain momentum based on time-varying risk premia and conditioning information also include Gu and Huang (2010), Guo (2006), and Wu (2002), among others.

[2] The NYSE and AMEX market indices are extracted from CRSP monthly tape and the data for Fama-French three factors are obtained from Kenneth French's website. We thank Kenneth French for generously making these data available to the public.