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Bias in estimating the systematic risk of extreme performers: Implications for financial analysis, the leverage effect, and long-run reversals

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ABSTRACT

We show how bias can arise systematically in the beta estimates of extreme performers when long-run return reversals are present and partly, or wholly, due to sign changes in unanticipated factor realizations. Our evidence is consistent with this bias being responsible for the large shifts in the beta estimates of extreme performers, more so than the leverage effect, which has been the predominant explanation in prior literature. Bias in these contemporaneous realized betas, estimated with the same returns that are to be risk adjusted, arises due to the general problem of "overconditioning," where betas are estimated conditional on information that is not yet known. Several methods for conditioning betas on out-of-sample returns are evaluated and found to be lacking, although some offer improvement under certain circumstances. We also show evidence of this bias in the Fama–French Three-factor loadings of extreme performers. Our findings indicate not only that previous studies of long-run reversals understate contrarian profits but that bias is prevalent in the OLS beta estimates of extreme performers, and this has implications for estimating the cost of capital and measuring long-run performance. We offer recommendations for identifying when this bias is likely present, as well as general methods to correct for it.

1. Introduction

Financial analysts and researchers prefer to estimate systematic risk over intervals of several years to increase precision. But long intervals can increase the challenge of estimating the systematic risk of extreme performers, which have been known to experience very large equity beta shifts. DeBondt and Thaler (1987), Chan (1988), Ball and Kothari (1989), Chopra et al. (1992), and Jones (1993) all observe that "realized betas" for extreme losers (winners), estimated contemporaneous with the returns to be risk adjusted, tend to increase (decrease) dramatically during and subsequent to the extreme performance. These papers differ markedly, however, in terms of how the authors interpret the shifts. Chan, and Ball and Kothari claim that the shifts are due to the leverage effect, which predicts that the equity betas of past losers (winners) will increase (decrease) due to higher (lower) financial leverage (see Hamada, 1972). Alternatively, DeBondt and Thaler, and Chopra, Ritter and Lakonishok are suspicious of these large shifts, noting that the betas of contrarian (i.e., loser – winner) portfolios tend to be high (low) in up- (down-) markets, when cumulative market returns are positive (negative). Jones argues that this asymmetric-risk pattern is due to the tendency of extreme performers to load on factor surprises (i.e., material differences between factor realizations and expectations) that underlie mean-reverting market returns and result in beta bias. Although these studies were all conducted as tests of the long-run

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contrarian strategy, reconciling their findings has important implications for estimating cost of capital, for risk adjustment in event studies, and for financial analysis, in general, since a better understanding of why these large beta shifts occur, and when they are likely due to bias, would allow for improved estimates of systematic risk.

While many of the potential sources of bias in estimates of systematic risk are well known, the source likely to systematically affect extreme performers has received scant attention. It is widely recognized, for example, that beta estimates can be biased due to thin trading and price adjustment delays (see Scholes and Williams, 1977, Dimson, 1979, and Cohen et al., 1983). However, there is significant disagreement about how, when, and even whether bias tends to arise in ordinary least squares (OLS) estimates of the systematic risk in extreme performers. Ball et al. (1995) attempt to correct for possible bias in the results of Ball and Kothari but find no material difference in the results and conclude there is little, if any, bias in the OLS estimates of extreme performers. Chan and Lakoishok (1992) observe it is "commonly believed" that the OLS beta estimates of losers (winners) are biased downward (upward), but they claim to demonstrate a lack of any such bias. More recently, Jacquier et al. (2010) detect little evidence of beta shifts in extreme performers and attribute this to changes in the value of the growth options, which tend to decrease (increase) the asset betas of losers (winners) so as to offset the leverage effect. So some papers have ignored potential bias in extreme performers' systematic-risk estimates, while others have at least attempted to correct for it, and still others have dismissed it as unimportant.

In this paper, we derive the forms that bias in OLS estimates of systematic risk can be expected to take when extreme performers load on underlying factor surprises that also contribute to long-run market returns. We specifically focus on the effects of what we call *factor reversals* (i.e., when the sign on a factor realization changes, relative to expectations) because these are likely a material source of the long-run return reversals observed in extreme performers. We show that in the presence of material factor surprises, the contemporaneous systematic-risk estimates of losers (winners) will be overstated (understated) in down-market formation periods and understated (overstated) in up-market formations periods. This bias is a result of "overconditioning," as defined in Boguth et al. (Forthcoming), where betas are estimated conditional on information that is not yet known. Subsequent reversals in factor realizations, relative to expectations, from the formation to observation period, would then overcondition the contemporaneous contrarian (loser – winner) betas estimates, or factor loadings, of the observation period so as to overstate (understate) them in up- (down-) markets and, thus, mistakenly attribute contrarian returns to risk. It is indeterminate whether factor reversals occur regularly enough to conclude that contrarian returns survive the Fama–French (1993) Three-factor model, on average. However, it is quite clear that a financial analyst or researcher attempting to estimate or forecast the systematic risk of a particular extreme performer, or a portfolio of extreme performers at a particular time, should be aware of the potential for this bias and be knowledgeable about how to identify and at least partially correct for it.

The remainder of the paper is organized as follows. Section 2 reviews the related literature on estimating the systematic risk of extreme performers, which incur long-run return reversals. In Section 3, we derive the forms that the bias will take across different methodologies when either unexpected factor-level reversals, or momentum, affect extreme performers. In Section 4, the betas and alphas of extreme performers are estimated empirically, for the various methodologies, to inspect for the presence of bias as predicted in Section 3. A corrected-conditional calendar-time methodology, that we introduce here, yields risk-adjusted contrarian alphas of almost 9% per annum based on the CAPM beta, indicating that the contemporaneous realized betas are heavily biased, in both calendar and event time. A plausible explanation for this is investor overreaction to funding conditions. In Section 5, the remaining two factors of the Fama–French Three-factor model reduce our corrected-conditional contrarian alpha to an insignificant level. However, we conclude that the Three-factor model estimates are also biased against detecting contrarian performance from factor reversals. Section 6 offers recommendations for how to identify and correct for this bias. Section 7 concludes that extreme performers' contemporaneous realized betas are heavily biased, that conditional estimates offer improvement only under certain conditions, and that the bias provides a more plausible explanation than the leverage effect for the large beta shifts of extreme performers.

2. A review of the literature on estimating the systematic risk of extreme performers

DeBondt and Thaler (1985) rank stocks on cumulative returns in each of a series of non-overlapping three-year formation periods and form portfolios of extreme winners and losers. They then compute the respective portfolios' returns in subsequent three-year observation periods and find that a contrarian (loser – winner) strategy produced average annual returns of about 8%. They also estimate lagged CAPM betas for the formation periods and find that the loser portfolios' betas are consistently lower than the winners' betas, and they interpret this as evidence that the contrarian returns cannot be explained by risk. Note that their portfolio-formation procedure tracks a unique portfolio of stocks in calendar time through the formation and subsequent observation period. We, therefore, refer to this as a *calendar-time* methodology.

Chan (1988) criticizes DeBondt and Thaler's use of lagged betas, arguing that the losers' (winners') increased (decreased) financial leverage, as a result of changes in the market value of equity, will increase (decrease) their levered betas, from the formation to the observation period. He, therefore, adjusts for risk with contemporaneous realized CAPM betas, from the observation period returns, based on Jensen (1968), and finds that the resulting alphas are insignificant. He also finds that the contrarian betas are higher in observation periods when the market premium is above average, and he attributes this covariance to the leverage effect. DeBondt and Thaler (1987), however, question whether these betas are appropriate for measuring contrarian performance since they co-vary with market returns.

Another response to DeBondt and Thaler came from Ball and Kothari (1989), who also estimate contemporaneous realized CAPM betas and alphas but use portfolios constructed with Ibbotson's (1975) well-known "*returns across time and securities*" (RATS) *event-time* procedure. Ball and Kothari form portfolios at annual intervals, and the returns for all the portfolios are pooled so there are five formation-period and five observation-period event years. A beta and alpha are then estimated for each of the