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Maxing out: Stocks as lotteries and the cross-section of expected returns ☆

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ABSTRACT

Motivated by existing evidence of a preference among investors for assets with lottery-like payoffs and that many investors are poorly diversified, we investigate the significance of extreme positive returns in the cross-sectional pricing of stocks. Portfolio-level analyses and firm-level cross-sectional regressions indicate a negative and significant relation between the maximum daily return over the past one month (MAX) and expected stock returns. Average raw and risk-adjusted return differences between stocks in the lowest and highest MAX deciles exceed 1% per month. These results are robust to controls for size, book-to-market, momentum, short-term reversals, liquidity, and skewness. Of particular interest, including MAX reverses the puzzling negative relation between returns and idiosyncratic volatility recently shown in Ang, Hodrick, Xing, and Zhang (2006, 2009).

1. Introduction

What determines the cross-section of expected stock returns? This question has been central to modern financial economics since the path breaking work of Sharpe (1964), Lintner (1965), and Mossin (1966). Much of this work has focused on the joint distribution of individual stock returns and the market portfolio as the determinant of expected returns. In the classic capital asset pricing model (CAPM) setting, i.e., with either quadratic preferences or normally distributed returns, expected returns on individual stocks are determined by the covariance of their returns with the market portfolio. Introducing a preference for skewness leads to the three-moment CAPM of Kraus and Litzenberger (1976), which has received empirical support in the literature as, for example, in Harvey and Siddique (2000) and Smith (2007).

Diversification plays a critical role in these models due to the desire of investors to avoid variance risk, i.e., to diversify away idiosyncratic volatility, yet a closer examination of the portfolios of individual investors suggests

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that these investors are, in general, not well-diversified.[3] There may be plausible explanations for this lack of diversification, such as the returns to specialization in information acquisition (Van Nieuwerburgh and Veldkamp, 2010), but nevertheless this empirical phenomenon suggests looking more closely at the distribution of individual stock returns rather than just co-moments as potential determinants of the cross-section of expected returns.

There is also evidence that investors have a preference for lottery-like assets, i.e., assets that have a relatively small probability of a large payoff. Two prominent examples are the favorite-longshot bias in horsetrack betting, i.e., the phenomenon that the expected return per dollar wagered tends to increase monotonically with the probability of the horse winning, and the popularity of lottery games despite the prevalence of negative expected returns (Thaler and Ziemba, 1988). Interestingly, in the latter case, there is increasing evidence that it is the degree of skewness in the payoffs that appeals to participants (Garrett and Sobel, 1999; Walker and Young, 2001), although there are alternative explanations, such as lumpiness in the goods market (Patel and Subrahmanyam, 1978). In the context of the stock market, Kumar (2009) shows that certain groups of individual investors appear to exhibit a preference for lottery-type stocks, which he defines as low-priced stocks with high idiosyncratic volatility and high idiosyncratic skewness.

Motivated by these two literatures, we examine the role of extreme positive returns in the cross-sectional pricing of stocks. Specifically, we sort stocks by their maximum daily return during the previous month and examine the monthly returns on the resulting portfolios over the period July 1962–December 2005. For value-weighted decile portfolios, the difference between returns on the portfolios with the highest and lowest maximum daily returns is −1.03%. The corresponding Fama-French-Carhart four-factor alpha is −1.18%. Both return differences are statistically significant at all standard significance levels. In addition, the results are robust to sorting stocks not only on the single maximum daily return during the month, but also the average of the two, three, four, or five highest daily returns within the month. This evidence suggests that investors may be willing to pay more for stocks that exhibit extreme positive returns, and thus, these stocks exhibit lower returns in the future.

This interpretation is consistent with cumulative prospect theory (Tversky and Kahneman, 1992) as modeled in Barberis and Huang (2008). Errors in the probability weighting of investors cause them to overvalue stocks that have a small probability of a large positive return. It is also consistent with the optimal beliefs framework of Brunnermeier, Gollier, and Parker (2007). In this model, agents optimally choose to distort their beliefs about future probabilities in order to maximize their current utility. Critical to these interpretations of the empirical evidence, stocks with extreme positive returns in a given month should also be more likely to exhibit this phenomenon in the future. We confirm this persistence, showing that stocks in the top decile in one month have a 35% probability of being in the top decile in the subsequent month and an almost 70% probability of being in one of the top three deciles. Moreover, maximum daily returns exhibit substantial persistence in firm-level cross-sectional regressions, even after controlling for a variety of other firm-level variables.

Not surprisingly, the stocks with the most extreme positive returns are not representative of the full universe of equities. For example, they tend to be small, illiquid securities with high returns in the portfolio formation month and low returns over the prior 11 months. To ensure that it is not these characteristics, rather than the extreme returns, that are driving the documented return differences, we perform a battery of bivariate sorts and re-examine the raw return and alpha differences. The results are robust to sorts on size, book-to-market ratio, momentum, short-term reversals, and illiquidity. Results from cross-sectional regressions corroborate this evidence.

Are there alternative interpretations of this apparently robust empirical phenomenon? Recent papers by Ang, Hodrick, Xing, and Zhang (2006, 2009) contain the anomalous finding that stocks with high idiosyncratic volatility have low subsequent returns. It is no surprise that the stocks with extreme positive returns also have high idiosyncratic (and total) volatility when measured over the same time period. This positive correlation is partially by construction, since realized monthly volatility is calculated as the sum of squared daily returns, but even excluding the day with the largest return in the volatility calculation only reduces this association slightly. Could the maximum return simply be proxying for idiosyncratic volatility? We investigate this question using two methodologies, bivariate sorts on extreme returns and idiosyncratic volatility and firm-level cross-sectional regressions. The conclusion is that not only is the effect of extreme positive returns we find robust to controls for idiosyncratic volatility, but that this effect reverses the idiosyncratic volatility effect shown in Ang, Hodrick, Xing, and Zhang (2006, 2009). When sorted first on maximum returns, the equal-weighted return difference between high and low idiosyncratic volatility portfolios is *positive* and both economically and statistically significant. In a cross-sectional regression context, when both variables are included, the coefficient on the maximum return is negative and significant while that on idiosyncratic volatility is *positive*, albeit insignificant in some specifications. These results are consistent with our preferred explanation—poorly diversified investors dislike idiosyncratic volatility, like lottery-like payoffs, and influence prices and hence future returns.

A slightly different interpretation of our evidence is that extreme positive returns proxy for skewness, and investors exhibit a preference for skewness. For example, Mitton and Vorkink (2007) develop a model of agents with heterogeneous skewness preferences and show that

[3] See, for example, Odean (1999), Mitton and Vorkink (2007), and Goetzmann and Kumar (2008) for evidence based on the portfolios of a large sample of U.S. individual investors. Calvet, Campbell, and Sodini (2007) present evidence on the underdiversification of Swedish households, which can also be substantial, although the associated welfare costs for the median household appear to be small.