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# Exploiting stochastic dominance to generate abnormal stock returns

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ABSTRACT

In this paper, we construct zero cost portfolios based on second and third degree stochastic dominance and show that they produce systematic, statistically significant, abnormal returns. These returns are robust with respect to the single index CAPM, the Fama-French three-factor model, the Carhart four-factor model, and the liquidity five-factor model. They are also robust with respect to momentum portfolios, transactions costs, varying time periods, and when broken down by a range of risk factors, such as firm size, leverage, age, return volatility, cash flow volatility, and trading volume.



## 1. Introduction

In this paper, we examine the relationship between the existence of second and third degree stochastic dominance and the behavior of stock returns. Stochastic dominance (SD) is a general approach to expected utility maximization, which is the cornerstone of modern investment theory and practice. Contrary to the popular but restrictive mean-variance framework,[2] the stochastic

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[2] Within the comprehensive framework of utility maximization mean-variance (MV) optimization, based on a single measure of risk, is the special case that is most widely accepted throughout the financial profession. MV, however, has a major shortcoming in that the conditions for it to be analytically consistent with expected utility maximization, such as quadratic

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dominance framework requires neither a specific utility function nor a specific return distribution. Under the general assumption that investors are risk averse, SD provides the probabilistic conditions under which all non-satiating, risk-averse investors prefer one risky asset to another. For example, the rules for second degree stochastic dominance (SSD) state the necessary and sufficient conditions under which one asset is preferred to another by all risk-averse expected utility maximizers.[3] The rules for third degree stochastic dominance (TSD) state the necessary and sufficient conditions under which one asset is preferred to another by all prudent risk-averse expected utility maximizers.

The indices and portfolios available to academics and practitioners for asset pricing and benchmarking are generally inefficient (e.g., Shalit and Yitzhaki, 1994; Post, 2003; Kuosmanen, 2004; Linton, Maasoumi, and Whang, 2005; Post and Versijp, 2007).[4] More recent studies investigate how stochastic dominance rules can be used to construct efficient portfolios (e.g., Kuosmanen, 2004; Clark, Jokung, and Kassimatis; Kopa and Post, 2011).

In this paper, we examine whether the rules of second and third degree stochastic dominance can be used to construct zero cost portfolios that yield out-of-sample systematic abnormal returns.[5] More specifically, we diverge from the mainstream SD empirical literature in that rather than concentrating on portfolio efficiency, we seek to determine whether ex post SD relations provide exploitable information on ex ante returns. The study is based on the argument that investors will exploit the ex post dominances by buying (selling) dominant (dominated) stocks, which will cause their prices to rise (fall). This creates capital gains (losses) for investors holding the dominant (dominated) stocks and reduces (increases) future returns. The intuition is that, ceteris paribus, over the adjustment period ex post dominant stocks will over-perform and ex post dominated stocks will under-perform.

Our empirical treatment targets second and third degree stochastic dominance and proceeds as follows. For each month of the sample period, we identify the dominant and dominated stocks in the second or third degree based on their daily returns from the previous six months. Once the dominance status of each stock has been determined, we form portfolios for each month that are long on dominant stocks and short on dominated stocks and examine the returns of these arbitrage portfolios up to 12 months into the holding period. The returns of the arbitrage portfolios are then used to examine our hypothesis for the market in the United Kingdom: that ex post SD relations provide exploitable information on ex ante returns.

In the paper's major contribution to the literature, our my results show that the zero cost SSD and TSD portfolios produce systematic, statistically significant, abnormal returns. These returns are robust when tested against the capital asset pricing model (CAPM), the Fama-French three-factor model, and an extended five-factor model that includes a momentum (Carhart, 1997) and a liquidity factor. Further tests suggest that the SD premia are not related to any of the conventional risk factors cited in the financial literature, such as firm size, leverage, age, return volatility, cash flow volatility, or trading volume. They are also robust with respect to transactions costs and varying time periods.

(*footnote continued*)
utility functions or normally distributed returns, seldom hold in practice (e.g., Mandelbrot, 1963). Furthermore, it has been shown that risk measures other than variance, such as the third and the fourth moments of return distributions—skewness and kurtosis respectively—do matter to investors, who show a preference for positive skewness and an aversion to kurtosis (Kraus and Litzenberger, 1976; Athayde and Flores, 1997; Fang and Lai, 1997; Dittmar, 2002; Post et al., 2008).

[3] See, for example, Hanoch and Levy (1969), Hadar and Russell (1969), and Rothschild and Stiglitz (1970). The rules are typically obtained by comparing the areas under the cumulative distributions of portfolio returns (e.g., Levy, 2006).

[4] On the other hand, some recent papers show that the efficiency of market indices cannot typically be rejected (e.g., Levy and Roll, 2010; Ni et al., 2011).

[5] Besides Shalit and Yitzhaki (1994), there is some preliminary, indirect evidence of a relationship between SD and stock market returns: Fong et al. (2005) on momentum; Shalit and Yitzhaki (2005) on diversification; Post (2005) on risk-seeking behavior; and Clark and Kassimatis (2012) on marginal conditional stochastic dominance.

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