Journal of Empirical Finance 23 (2013) 187–190

Contents lists available at ScienceDirect

Journal of Empirical Finance

journal homepage: www.elsevier.com/locate/jempfin

Aggregate investor preferences and beliefs: A comment

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ARTICLE INFO

Article history:
Received 7 February 2013
Received in revised form 28 June 2013
Accepted 30 June 2013
Available online 13 July 2013

JEL classification:
C22
C32
D81
G11
G12

Keywords:
Stochastic dominance
Utility theory
Risk aversion
Linear programming
Market portfolio efficiency
Asset pricing

ABSTRACT

A recent study in this journal presents encouraging results of a daunting simulation analysis of the statistical properties of a centered bootstrap approach to stochastic dominance efficiency analysis. However, by relying on the first-order optimality condition in a situation where multiple optima may occur, the empirical analysis draws the questionable conclusion that some of the toughest data sets in empirical asset pricing can be rationalized by the representative investor maximizing an S-shaped utility function, consistent with the so-called Prospect Stochastic Dominance criterion. Further research could be directed to developing global optimization algorithms and consistent re-sampling methods for statistical inference for general risky choice problems.

1. Introduction

Is the passive stock market portfolio efficient or is it dominated by concentrated stock portfolios and active trading strategies? Fang (2012) aims to shed new light on this important issue by applying various stochastic dominance criteria that allow for local risk seeking behavior. The study concludes that the market portfolio is Prospect Stochastic Dominance (PSD) efficient, consistent with investors maximizing an S-shaped utility function (risk seeking for losses and risk aversion for gains).

This conclusion is remarkable, because behavioral portfolio theory predicts a 'four-fold pattern' (risk aversion for large losses and small gains and risk seeking for small losses and large gains) based on the combination of an S-shaped value function and a reverse S-shaped probability weighting function. The probability distortion outweighs the curvature of the value function for large gains and losses, leading to a demand for downside protection (insurance policies) and upside potential (lottery tickets). In addition, Prof. Fang examines some of the toughest data sets in empirical finance: investment returns to active stock portfolios formed on valuation multiples, price momentum and price reversal. It would be remarkable if these returns could be explained by rational risk premiums (or risk discounts?), without using common market-microstructure explanations such as liquidity problems and transaction costs.

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[1] He kindly acknowledges the support of the Czech Science Foundation (grant 402/12/0558).

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http://dx.doi.org/10.1016/j.jempfin.2013.06.003

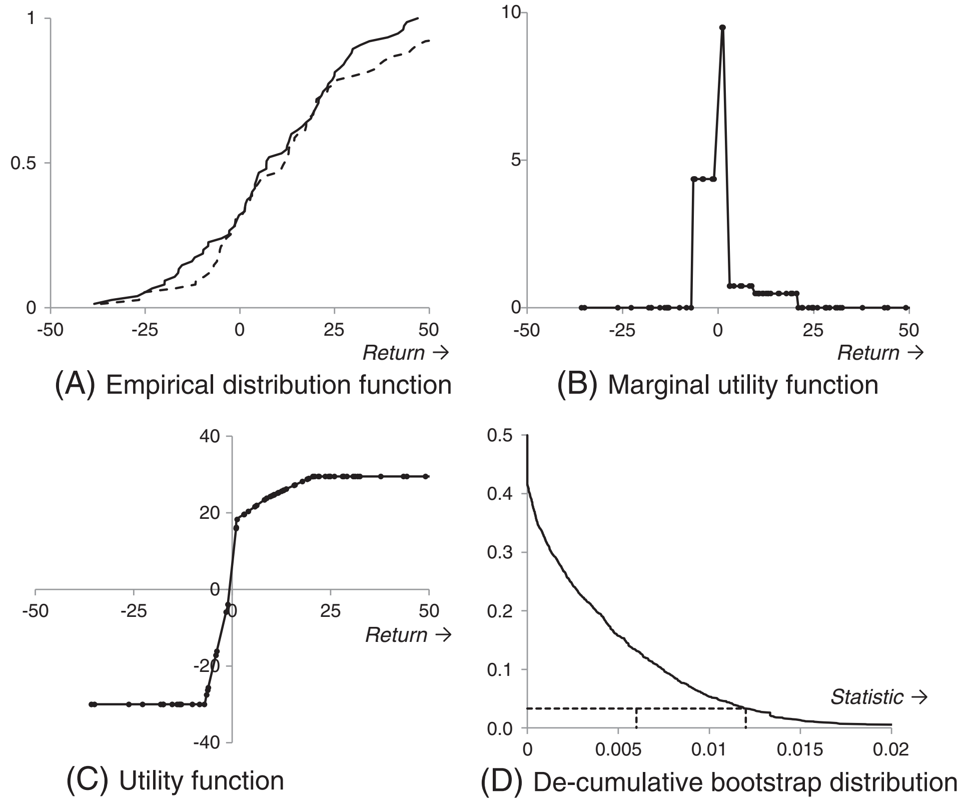

Fig. 1. Analyzing Market Portfolio Inefficiency. The below graphs illustrate various tests for efficiency of the CRSP all-share index relative to the 25 Fama–French size-value portfolios and the one-month T-bill using annual excess returns from 1933 to 2007. Panel A compares the empirical distribution function of the large-growth portfolio (solid line) with a combination of two-thirds invested in the small value portfolio and one-third in T-bills (dashed line). An ex-post FSD dominance relation occurs if the first portfolio has a higher shortfall probability than the second portfolio for every return level. Panel B shows the piece-wise constant marginal utility function constructed from the optimal gradient vector of the PSD efficiency test. The dots represent the observed excess return levels of the market index. Panel C shows the associated piece-wise linear utility function, using the method of Post (2003). Panel D shows the de-cumulative bootstrap distribution of the FSD efficiency test statistic of Kopa and Post (2009) based on 10,000 bootstrap pseudo-samples of 75 observations obtained by randomly sampling with replacement from the original data set of annual excess returns. Fang's (2012) EDB bootstrap p-value is the fraction of the pseudo-samples where the FSD efficiency test statistic is at least twice as large as value in the original data set.

We believe that Fang's results and conclusions rely on a necessary but not sufficient first-order optimality condition in a situation where the market portfolio can be shown to be First-order Stochastic Dominance (FSD) inefficient to a significant degree and hence not the global optimum for any increasing utility function. Paradoxically, the consistency of Fang's results across different benchmark portfolios, various horizons and rolling window samples, seems to underline the weakness of the necessary condition rather than the evidence in favor of PSD preferences. For the sake of brevity, we focus on the data set of annual excess returns (1933–2007) to the 25 Fama–French value-weighted ME-B/M portfolios and the one-month T-bill. Similar results are obtained for Fang's other data sets. The four panels of Fig. 1 summarize our arguments. Before presenting a formal test of portfolio efficiency, we will first illustrate the challenging patterns in the data set and the pitfalls of using the first-order condition.

Panel 1-A compares the empirical distribution function (EDF) of the Fama–French large-growth portfolio (solid line) with a combination of two-thirds invested in the small value portfolio and one-third in T-bills (dashed line). The graph shows a near-perfect FSD dominance relation; the large-growth portfolio has a higher shortfall probability than the small-value portfolio for almost every return level. Other, more complex combinations of the 25 portfolios and the T-bill show even stronger dominance patterns. It is not trivial to quantify the joint statistical significance of these pairwise dominance relations. However, random sampling variation is more likely to distort an existing dominance relationship than to introduce a spurious dominance relationship, as dominance requires a complex set of inequality conditions. A formal test of portfolio efficiency is presented below.

The below table shows the expected utility for the 25 portfolios using three different utility functions and based on the empirical return distribution of annual excess returns. The shaded cell represents the global optimum in every panel. The first case is a standard logarithmic utility function (global risk aversion). Confirming known results, this investor would invest her wealth in small value stocks. The second panel shows results for the standard (S-shaped) Prospect Theory value function with Kahneman–Tversky median parameter values. If anything, the preference for small value stocks over large growth stocks is even stronger for the value function than for the logarithmic utility function. The third function is a step function with a single step at zero, a limiting case of the PSD utility functions. Clearly, this function is too extreme to represent realistic risk preferences, because it is indifferent to the magnitude of gains and losses and extremely sensitive to the choice of the reference point. Nevertheless, this investor still chooses small value stocks; the