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On the power of cross-sectional and multivariate tests of the CAPM

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ABSTRACT

This paper examines the power of the cross-sectional and multivariate tests of the CAPM under ideal conditions. When the CAPM is true the positively weighted market portfolio is MV-efficient and securities plot on the security market line. When the CAPM is false an alternative asset pricing model determines prices. An examination of the population intercepts, slopes and R^2 from cross-sectional regressions of expected returns on betas indicates that all three are unreliable indicators of whether the CAPM holds. Simulation analysis of the power of the cross-sectional tests expands on and reinforces the analysis based on the population values. The Gibbons et al. (1989) multivariate test fares much better.

1. Introduction

In early tests of the Sharpe (1964)–Lintner (1965) mean-variance capital asset pricing model (MV CAPM), Black et al. (1972), Blume and Friend (1973) and Fama and MacBeth (1973), among others, find the estimated relationship between average excess return and beta is too flat and the intercept is positive. This led to a consensus that the Sharpe–Lintner riskfree rate version of the CAPM should be rejected and replaced by Black's (1972) zero-beta version. More recently, Fama and French (1992) find that beta alone does not explain the cross-section of expected returns. Rather, size and book-to-market equity combine to capture the cross-sectional variation in average stock returns associated with market beta, size, leverage, book-to-market equity and earnings price ratios. This led to the highly contentious assertion: the CAPM is dead. Subsequently, Fama and French (1993, 1996) develop a three-factor alternative to the CAPM and extensively test both models employing multivariate time-series tests. However, two streams of literature are concerned with the efficacy of the tests. The first stream focuses on econometric issues: developing new testing procedures, extending the tests to conditional models, and examining the power of the tests. The second stream focuses on economic issues and population parameters identifying problems with the tests in a single-period framework.

In the first stream, Jobson and Korkie (1982, 1985), Amsler and Schmidt (1985), MacKinlay (1987, 1995), Gibbons et al. (1989), Affleck-Graves and McDonald (1990), and Campbell et al. (1997), among others, examine the power of multivariate tests. Kan and Zhang (1999), Chen and Kan (2006), Lewellen et al. (2006), and Shanken and Zhou (2007), among others, examine the power of cross-sectional tests. Kan and Zhang (1999) highlight a surprising statistical property of the standard two-pass cross-sectional regression methodology: a factor uncorrelated with asset returns will appear to be priced with high probability. Lewellen et al. (2006) contend asset pricing tests are often highly misleading because high cross-sectional R^2 and small pricing errors, when more than one factor is used in explaining average returns on size/book-to-market portfolios, provides quite weak support for a model. Shanken and Zhou (2007) conduct a simulation analysis of the Fama and MacBeth (1973) two-pass procedure, as well as maximum likelihood and generalized method of moments estimators of cross-sectional expected return models. Their simulations show there is little power to reject the hypothesis that the slope of the cross-sectional regression of means on betas is equal to zero. Concurrently, Chen and Kan (2006) provide analytical results on estimation bias as well as simulation evidence. Lo and MacKinlay (1990) and MacKinlay (1995) maintain that the CAPM anomalies may be the result of data snooping. Ferson et al. (2008) examine the combined effects of data snooping and spurious regression in conditional asset pricing models. Finally Simin (2008) highlights the poor predictive performance of conditional and unconditional asset pricing models.

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