A Quantile Regression Analysis of the Cross Section of Stock Market Returns

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Key words: CAPM; semi-parametric regression; errors-in-variables; Monte Carlo simulation; cross section analysis; under and over performing stocks.

JEL Classi…cations: G12, C14, C21

Abstract

In recent years, many researchers have empirically tested the Capital Asset Pricing Model (CAPM) by considering a cross section regression of the excess market return of an asset or portfolio on beta and other conditioning variables. These studies generally follow the two-pass method originally considered by Fama and MacBeth (1973), where betas are estimated from a time series regression and these values are used to explain variation in the cross section of subsequent expected return. We focus on the second stage. The traditional approach su¤ers because it only considers the performance of the CAPM at the mean of the conditional distribution. In this paper, we extend the literature by using quantile regression, developed by Koenker and Bassett (1978) and recently popularized by Buchinsky (1998), to analyze this cross sectional stage of the problem. This method enables us to estimate the marginal e¤ect of a change in an independent variable on any conditional quantile of the dependent variable and thus test whether the conditional CAPM holds at all points of the conditional distribution. By doing this, we are able to model the performance of …rms or portfolios that under or over perform, in the sense that the conditional mean over or under predicts the return of the portfolio.

[1]Preliminary and incomplete …rst draft, please do not quote without permission. This research was partially supported by an Australian Research Council Grant. Naturally, any remaining errors are the authors' responsibility.

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Several theoretical issues emerge from this analysis. The …rst of these is that …rm speci…c betas are estimated imprecisely using the data, leading to a classic error-in-variables scenario. In the paper, we use Monte Carlo experiments to explore the bias properties of least absolute deviation (LAD) and quantile regression under these circumstances and …nd, among other results, that LAD su¤ers less bias than OLS. The second theoretical issue involves e¢cient weighted quantile regression. Here we follow Fama and French (1994) and Ferson and Harvey (1999) and develop this estimator. We then apply the estimator to CRSP data containing …rms listed on the NYSE.

The results indicate that coe¢cient values di¤er widely across the conditional distribution. For example, for low quantiles, the marginal e¤ect of an increase in beta-risk is associated with lower expected returns, whereas for quantiles close to the median and for upper quantiles, this e¤ect is positive. As we move into the upper tail, however, the quantile plot dips and the coe¢cient becomes insigni…cant. Another example is that for lower quantiles, the size of a …rm is positively associated with expected returns but for higher quantiles, this association is negative. Finally, we consider forecasting stock returns using quantile regression. We …nd that if each …rm's quantile can be predicted accurately, forecasts based on quantile regression are far superior than those based on OLS.