Cap 6 Bali, Engle, and Murray (2016)

domingo, 18 de outubro de 2020 05:20

FAMA-MACBETH REGRESSION

Introduction

- FM regression is a parametric technique that enable us to examine the relation between pairs of variables while including many controls in the analyses
- One cost of this approach is the assumption that the relationship between the variables of interest are linear

6.1. Implementation

- Implemented using two-step procedure
- The first step consists of running a periodic cross-sectional regression on the dependent variable y against one or many independent variables $X_1, X_2, \dots, X_m$, using time series data
- This procedure results on estimates for the fixed coefficient, and slope coefficients for each independent variable for each t.
- The second step consists of analysing the time series of slope coefficients to determine whether the average coefficient differs from zero

6.1.1. Periodic Cross-sectional Regressions

- Our cross-sectional regression specification is:

$$y_{i,t} = \delta_{0,t} + \delta_{1,t} X1_{i,t} + \delta_{2,t} X2_{i,t} + \dots + \varepsilon_{i,t}$$

where independent variables are typically winsorized, and when the dependent variable is not excess return its also winsorized.

- The result is a time series of:
  (a) parameters $\delta_{0,t}, \delta_{1,t}, \dots$
  (b) regression statistics such as $R2$, Adj-$R2$, # of obs, which we can denote R^2_t, Adj-R^2_t, N_t.
- This step can be estimated using OLS, WLS, or even logistic reg.

EXAMPLE

$$ret_{i,t+1} = \delta_{0,t} + \delta_{1,t}\,\beta_{i,t} + \delta_{2,t}\,size_{i,t} + \delta_{3,t}\,BM_{i,t} + \varepsilon_{i,t+1}$$

- $ret_{i,t+1}$: one-year ahead excess return of stock i
- $\beta_{i,t}$: market port. risk loadings
- $size_{i,t}$: log of the market cap.
- $BM_{i,t}$: book-to-market value ratio

6.1.2. Average Cross-sectional Regression Results

- The second step of the FM regression consists in computing the time-series averages of the periodic cross-sectional regression results and other statistics ($R2$, Adj-$R2$, N)
- Our goal is to test whether the average coefficient is statistically different than zero
- Therefore, we need to compute standard errors, t-statistics, and p-values to test the null hypothesis that the average coefficient is = 0

6.2 Interpreting FM Regressions

- Statistically significant average slope coefficient indicates a CS relation between the independent variable X and the independent variable Y in the average time period

$p < 0.05 \Rightarrow$ t-stat > 2 (usually the lower bound for significance)

- In addition, its useful to investigate if the statistically significant relation is economically meaningful
  (1) There are situations where the change in one unit in X can be easily interpreted, therefore its easy to evaluate its economic importance
  (2) Asses the effect of one std-dev. change in X on Y. To do this, we multiply the average slope coefficient by the cross-sectional std-dev. of X in the average period
  (3) Percentiles comparison

- Paston, Stambaugh, and Taylor (2018) show that for:
  (a) Univariate regression specification (one independent variable)
  (b) Balanced panel data (same entities in each cs)
  (c) Cross-sectional variance of the independent variable is constant across all time periods

  $\Rightarrow$ Average slope coefficient of FM regression is identical to the slope generated by panel regression with time fixed effects.

From Chapter 1 - Section 1.1: Sample

- Each statistical methodologies presented in this book is performed using panel data
- Each entry in the panel corresponds to a particular combination of entity i, and time period t

  i: stocks, bonds, options, or firms
  t: months, weeks, quarters, years, and days

- The data corresponding to any given time period are referred to as a cross section
- In most cases, the sample is not a full panel, which means that the number of entities i can vary with time
- For each pair (i,t), the data include several characteristics X, which we refer $X_{i,t}$
- Part 1 of the book assumes that each entity i corresponds to a stock, and t corresponds to a year
- The sample corresponds to 25 years (1948-2012), where for each year the sample includes all stocks i in the CRSP database that are listed as US-based common stocks on December 31 of year t
- Part 2 uses the same data in monthly frequency
- For each observation in the sample we calculate:
  (a) β of stock i in year t as the slope coefficient from a regression of excess return of stock i on excess return of the market portfolio using daily data during all year t
  (b) Market capitalization (Mktcap) for stock i in year t as the number of outstanding shares times the price of the stock at the end of year t divided by 1MM. We take the size = log(Mktcap)
  (c) Book-to-market ratio (BM) is computed as the book value of the firm's equity divided by market value of the firms equity (Mktcap)
- Stock return, price, and shares outstanding data comes from CRSP data
- Book value of equity data comes from Compustat
- Risk-free security data comes from Kenneth French data library