Problem Set 5

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Names of whom I discussed this problem set with:

Data Source

1. **CRSP Stock Data:** WRDS →CRSP > Annual Update > Stock / Security Files > CRSP Monthly and CRSP Daily Stock files. Took data from Dec 2012 – Dec 2015.
   (One extra month as the desired output is from Jan 2013 to Dec 2015 and hence to avoid data loss during shift command. Output would be exact as required from Jan 1973 to Dec 2017).
   Variables (PERMNO, share code, exchange code, RET, DLRET, PRC, share outstanding)

2. **Fama French 3 factor Portfolio**: From FF website → F-F_Research_Data_Factors.CSV daily and monthly data.

Data cleaning steps

In both Daily and Monthly stock data –

1. **Universe of stocks**: Following Ang, Hodrick, Xing, and Zhang procedure, I restrict the sample to securities traded in the New York Stock Exchange, American Stock Exchange, or the Nasdaq Stock Exchange (exchange codes 1, 2, and 3) in both daily and monthly files.

2. **Missing returns**: Returns which are marked with characters(non-numeric) due to reasons viz. No valid comparison for an excess return, no listing information, no valid previous price, Off-exchange, Out of Range, no valid price has been marked as NA.

3. **Date Format**: Date column has been formatted as YearMonth (MMM YYYY).

4. **Delisting return calculation**: All non-numeric delisting returns have been converted to NA

5. **Adjusted holding period Return:** Following method has been used to calculated adjusted holding period return from "holding period return" $r^{h}_{i,t}$ and delisting return $r^{d}_{i,t.}$

$$r_{i,t} = \begin{cases} r^h_{i,t} & \text{if } r^d_{i,t} \text{ missing} \\ r^d_{i,t} & \text{if } r^h_{i,t} \text{ missing} \\ (1 + r^h_{i,t})(1 + r^d_{i,t}) - 1 & \text{if both not missing} \end{cases}$$

6. **Sample period**: Sample period taken is Dec 2012 to Dec 2015.

Only in Daily stock data -

7. In daily stock file, stocks trading for 17 or more days in a month have been considered for analysis.
8. Retain only entries where adjRet calculated in step 5 is not NA, for further analysis.

Only in Monthly stock data -

9. **Negative Price**: Negative price in CRSP data is bid-ask average. Absolute value of price has been taken.

10. **Lagged Market Capitalization**: price of stock has been multiplied with outstanding shares Then it's been shifted by one month

11. **Portfolio weights**: Weight for each stock has been calculated dividing market cap of each stock by sum of total market cap for each month.

Fama Fench 3 factor daily and monthly data -

12. Date formatted as %Y%m%d

13. All the values in the file are in percentage so they are divided by 100 to make it decimal

Calculating the volatility measures using daily data

1. **Total Volatility:** For total volatility, standard deviation of daily adjusted holding period return has been calculated for each stock, each month.

2. **Merging daily stock data with FF3 factor daily data:** To get the Mkt-RF, SMB and HML factor for each entry in daily stock file, two files have been merged keeping all the entries for Stock file data (left join).

3. **Idiosyncratic volatility:** To calculate idiosyncratic volatility, daily adjusted holding period return has been regressed on excess market return, SMB and HML factors. Square root of residual volatility has been stored as idiosyncratic volatility.

4. **Merging daily stock file with monthly file:** Using unique data from daily files, total volatility and idiosyncratic volatility columns have been merged with monthly file, keeping all the data in monthly file.

Calculating portfolio statistics using monthly data

1. **Total Volatility Quintiles:** Stock each month have been cut in to five quintiles using their total volatility with quintile 1 as lowest volatility and quintile 5 as highest volatility.

2. **Idiosyncratic Volatility Quintiles:** Stock each month have been cut in to five quantiles based on their idiosyncratic volatility. Again quintile 5 as lowest and quintile 5 as highest idiosyncratic volatility.

3. **Market Share:** Market share for each quintile has been calculated each month, based on sum of market cap of stocks in that quintile divided by sum of market cap of stocks in all 5 quintiles. (Same procedure for total volatility and idiosyncratic volatility quintiles).

4. **Value weighted return**: Monthly value weighted return have been calculated for each quintile for both total volatility and idiosyncratic volatility quintiles.

5. **CAPM alpha and Newey West t-stat:** Capm alpha and Newey West t-stat have been calculated regression monthly excess returns of each quintile against excess market return.

6. **FF3 Alpha and Newey West t-stat:** FF3 alpha and Newey West t-stat have been calculated regression excess return over, excess market return, SMB and HML factors.

Rank	Mean	Std. Dev.	%Mkt Share	Size	CAPM Alpha	FF-3 Alpha
Panel A: Portfolios Sorted by Total Volatility						
1	1.09	2.64	30.72	6.51	0.18 [0.64]	0.13 [0.51]
2	1.14	3.07	35.81	7.28	-0.01 [-0.07]	-0.02 [-0.17]
3	1.01	3.58	20.45	6.8	-0.30 [-1.17]	-0.27 [-1.17]
4	0.44	4.07	9.61	6.04	-0.89 [-1.55]	-0.76 [-1.53]
5	0.21	4.81	3.41	4.97	-1.12 [-1.32]	-1.02 [-1.36]
Panel B: Portfolios Sorted by Idiosyncratic Volatility Relative to FF-3						
1	1.12	3	38.46	6.82	0.01 [0.09]	-0.03 [-0.18]
2	1.12	3	31.68	7.22	0.00 [0.02]	-0.01 [-0.08]
3	0.77	3.38	17.96	6.72	-0.45 [-1.49]	-0.42 [-1.55]
4	0.63	4.08	8.67	5.97	-0.74 [-1.43]	-0.64 [-1.39]
5	0.23	4.55	3.23	4.88	-0.98 [-1.15]	-0.87 [-1.18]

I have calculated mean and std. deviation of actual monthly return (and not excess return). Market share represents share of total market in each quintiles. Size has been calculated using average of log market caps (market cap converted into millions).

We can observe an anomaly here in the form of different in the mean return and alpha of rank 1 and rank 5 quintile portfolio. Mean return increases from quintile 1 to quintile 2 and then decreases from quintile 3 to quintile 5.

References-

- Wharton Research Data Services (WRDS) CRSP data taken on May 20, 2018 (CRSP > Annual Update > Stock / Security Files > CRSP Monthly Stock and daily stock).
- http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html (FF -3 factor file, daily and monthly)
- The Cross-Section of Volatility and Expected Returns ANDREW ANG, ROBERT J. HODRICK, YUHANG XING, and XIAOYAN ZHANG (THE JOURNAL OF FINANCE • VOL. LXI, NO. 1 • FEBRUARY 2006)